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Current Status and Optimization Strategies of Physical Fitness Training for the Elderly in the Digital Age

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Abstract: With the advent of digital technology and the improvement of people's living standards, the decline of physical fitness among the elderly has become an urgent problem to be addressed. Physical fitness typically includes abilities such as strength, flexibility, agility, speed, coordination, and other capacities, which not only play an important role in athletic performance but are also crucial for the daily lives of the elderly. This study investigates the current state of physical fitness training for the elderly in the digital age and aims to explore the optimization of scientific approaches and the role of digital products in improving training strategies. Through literature research and logical analysis, this paper collects and analyzes related data to further explore the status of the elderly's physical fitness training and their training strategies under the empowerment of science and technology. The investigation of related materials reveals that currently, the elderly have a low awareness of scientific training, especially regarding the concept of scientific training. Moreover, the main activities engaged in by the elderly for physical fitness training are fitness Qigong, square dancing, and other similar projects, which indicates that the elderly tend to engage in aerobic exercises and meet their psychological needs through group activities. By integrating current large-scale digital technologies and scientific products, the paper proposes optimization strategies for the elderly's training. These include utilizing robot learning and smart devices to collect information through smart devices, analyzing the collected data using large models to develop individualized training programs to improve efficiency. Additionally, wearable devices like smart bracelets, Firstbeat heart rate monitoring systems, and Gymaware monitoring systems can collect data on the body, reflecting physical conditions and further reducing the risk of injury. VR virtual interactive technology can be used to train cognitive responses, and VBT technology can make exercises more efficient, reducing the risk of injury. As technology continues to advance and awareness increases, achieving a healthy China is within reach.

Keywords: Elderly; Physical Fitness Training; Digitalization; Technology.

1. Introduction

Since the beginning of the 21st century, with the continuous development of the Industrial Revolution, digital industries have emerged like bamboo shoots after rain, bringing about a qualitative change in the integration of technology and physical fitness [1], which has had a profound impact on our lives and improved the scientific nature of physical fitness training. On January 16, 2016, the Central Committee of the Communist Party of China issued the "Healthy China 2030" planning outline, and in September 2017, the "Healthy China Action (2019-2030)" was introduced, both of which elevate physical health to a significant level. The elderly account for a large proportion of the national population; according to data released by the National Bureau of Statistics and the Ministry of Civil Affairs of China, as of the end of 2022, there were 280 million people aged 60 and above, accounting for 19.8% of the total population; and there were 209.78 million people aged 65 and above, accounting for 14.9%. [2] To achieve the ambitious goal of a Healthy China, the health of the elderly must be given considerable attention.

Physical fitness plays an extremely important role in the lives of the elderly, including aspects such as daily life: running, lifting heavy objects. In terms of disease prevention: improving physical immunity, enhancing resistance; in terms of psychology: reducing anxiety, alleviating stress, improving mental health. Enhancing memory and cognitive function: effective physical fitness training can significantly delay age-related memory decline, improving the cognitive function of aMCI (older adults with mild cognitive impairment), especially in general cognition, immediate memory, and language ability; improving physique: for example, older adults with MCI (mild cognitive impairment) who perform aerobic exercise four times a week for 6 months [3], when the target heart rate reserve is 75% to 85% [4], show significant improvement in executive function. However, due to physical conditions, the elderly often cannot perform corresponding exercises or are easily injured during training. In this context, the emergence of big data technology has made it possible to promote the data-driven, objective [5], and precise monitoring of physical fitness training, making training safer and more efficient.

2. Purpose and Significance of the Study

This study aims to analyze the current state of physical fitness training among the elderly both domestically and internationally, delve into the motivations and types of projects they engage in for physical fitness training, and explore a series of policies and methods for optimizing the physical fitness training system for the elderly under the empowerment of digital technology, providing theoretical support for the scientific nature of the elderly's physical fitness training.

In today's era of digital technology, physical fitness training is becoming increasingly systematic and scientific. The proliferation of various big data models, electronic devices, and virtual interactive products is pushing physical fitness training towards a more scientific path. However, most products are used in competitive sports and rarely applied to ordinary people or the elderly's physical fitness training. This

mindset leads to a lack of systematic application of big data technology in elderly physical fitness training. Therefore, studying the systematic strategies for elderly physical fitness training will help not only physically but also mentally rejuvenate the elderly, contributing to the realization of the Healthy China grand goal.

3. Current State of Elderly Physical Fitness Training

Physical fitness is extremely important for the daily work and life of the elderly, but research indicates that the elderly generally lack awareness of physical fitness training, and most do not know the health benefits of physical fitness training [6]. Therefore, it is necessary to strengthen their attention to physical fitness and improve their awareness. Investigations into the types of physical fitness training projects engaged in by the elderly show that the main activities include Tai Chi, Ba Duan Jin (a form of Qigong) [7] [8], and square dancing, which are chosen because these activities are low-intensity and satisfy the psychological needs of the elderly.

3.1. Strength Training

Strength is an important aspect of life for the elderly, whether walking, running, or working, muscle strength is essential. Muscle strength has long been considered an important factor in elderly falls and fractures [9]. With aging, metabolic rates decrease, muscle volume and strength decline, leading to falls, fractures, and decreased bone density, which affect the lives and work of the elderly to some extent. Currently, the main methods for the elderly to train strength focus on simple running, jumping rope, Tai Chi, and other activities. Although these activities can enhance muscle strength to some extent, they lack scientific guidance and systematic training cycles, resulting in less effective training outcomes.

3.2. Flexibility Training

Flexibility refers to the range of motion of each joint and the stretching capacity of muscles, tendons, and ligaments. As people age, the organic matter in joint capsules and ligaments decreases, leading to reduced joint flexibility [10]. Research also shows that flexibility declines with age, limiting movement range [11]. Moreover, decreased flexibility indicates muscle imbalance, which can lead to early fatigue. The elderly's understanding of flexibility training is insufficient, and there are misconceptions. Most people frequently engage in activities such as dancing, Tai Chi, and Ba Duan Jin for flexibility exercises, which maintain and enhance flexibility. Additionally, many people simply consider flexibility to be about being able to move hands and feet freely. Thus, based on this understanding, flexibility training for the elderly is often overlooked or limited to simple leg stretching and arm movements. Particularly for those who enjoy competitive sports like basketball and volleyball, post-exercise stretching is crucial but often neglected, leading to reduced flexibility over time.

3.3. Speed Training

This study focuses on reaction speed as the object of study for elderly speed training, not including action speed and displacement speed. As people age, their reaction speed gradually decreases, causing inconvenience in daily life and longer completion times for fine motor tasks. Currently, most elderly people train reaction speed through aerobic exercises like Tai Chi and Ba Duan Jin, which can effectively improve reaction speed and cognitive ability [12]. As people age, the nervous system also deteriorates, with studies indicating that the ability to control complex and refined movements declines with age, leading to increased reaction times [13]. During Tai Chi and Ba Duan Jin exercises, the entire muscle group is exercised, which not only improves reaction speed but also promotes neurological function, inhibiting the decline in cognitive ability and reaction speed. However, due to the lack of effective guidance during exercise, incorrect movements can cause joint and bone injuries.

4. Digital Technology Empowerment in Physical Fitness Training

The integration of big data technology into the field of competitive sports has strongly promoted the data-driven, objective, and precise monitoring of physical fitness training and exercise [14]. Digital empowerment makes physical fitness training more refined and scientific. Based on a wealth of data, personalized training programs can be developed using large model analyses. With smart exercise equipment, fitness watches, biosensors, it is possible to reflect the physical condition of the elderly in real-time, making physical fitness training more efficient and scientific.

4.1. Methods of Physical Fitness Training

Under technological support, new vitality has been injected into elderly physical fitness exercise. For strength training, the elderly can go beyond low-intensity aerobic exercises like Tai Chi, dancing, and running. With technology support, VBT technology can be used to assist with resistance training, allowing individuals to set goals and ensure safety during training. For traditional flexibility training, wearing biosensors combined with ForceFrame systems or plane photography techniques can standardize movement positions, avoiding interference from other incorrect movements and making training more rational and scientific. For speed training, smart wristbands can be used in combination with various sensors in smartwatches to indirectly determine the reaction speed of the elderly. This is the simplest and most operable method. Additionally, specialized APPs for elderly reaction speed training can be used for training. With the development of AR virtual interaction technology, VR can also be used to set up virtual scenarios to test reaction speed and improve cognitive response in the elderly. In the era of big data, the development of intelligent robots also provides another way for elderly training.

4.2. Monitoring of Physical Fitness Training

No matter what kind of physical exercise the elderly engage in, safety and efficiency are paramount. In the era of digital empowerment, risk monitoring has become a reality. Wearing smart wristbands, Firstbeat heart rate monitoring systems, Gymaware monitoring systems, and other devices can collect data on the body, reflecting physical conditions and further reducing the risk of injury. Using big data analysis to predict health problems in the elderly and take preventive measures in advance is also possible. For example, physiological and biochemical indicators can reflect muscle fatigue and predict neurological issues.

Furthermore, machine learning can analyze large amounts

of data to develop personalized physical fitness training programs and predict potential injury risks, eliminating them before they occur. In the era of big data, training becomes more efficient and scientific, greatly reducing the risk of injury.

5. Principles of Elderly Physical Fitness Training

The so-called principles are reasonable phenomena summarized from long-term experience and are the criteria for action. Only by following these principles within the scope of the criteria can good results be achieved in training.

5.1. Principle of Gradual Progress

The principle of gradual progress holds a significant place in the training process of the elderly, especially when they first start physical fitness training. At this stage, it is crucial to pay attention to load changes, ensuring that the elderly adapt to the load before increasing it. After loading, energy replenishment is necessary, along with adequate rest to achieve supercompensation.

5.2. Individualization Principle

Each elderly person has different physical conditions. Accurately determining their physical state through big data analysis can develop specialized training methods, taking their physical fitness to new heights.

5.3. Consistency Principle

Changes in body shape are due to changes in the internal physiology of the human body. The body shape and quality changed by load need to be maintained continuously. Without consistency, the physical fitness gained through training will gradually disappear.

5.4. Diversification Principle

For the elderly, training methods can adopt new technologies such as VR, smart watches, and machine learning, increasing the fun and safety of training.

5.5. Safety Principle

The purpose of exercising is to enhance physical fitness and longevity, so safety must be prioritized during training. Regular physical examinations are necessary to ensure safe participation in physical fitness training and achieve improved physical quality.

6. Conclusion

In the era of big data, elderly physical fitness training will become more scientific. The application of new technologies such as VR virtual scenarios, smart devices, biosensors, plane photography techniques, big data models, and machine learning in training will elevate elderly physical fitness training to a new level. Currently, the application of new technologies in elderly physical fitness training in China is limited. On one hand, the elderly are unfamiliar with emerging tech products and doubtful; on the other hand, costs are high during the training process. However, the arrival of 5G technology greatly reduces the cost of elderly physical fitness training. For example, Huawei's sports watch contains built-in sensors that regularly check the body's condition. Combined with mobile phone sports APPs that collect data over a long period, they can accurately identify the body's state, laying the foundation for intelligent and scientific training. With the advancement of technology, its broader application among the elderly is expected.

References

[1] Huang Kaiyong, Zhu Jiabin. Technology and Physical Fitness: A Future in Fusion [C]// Chinese Society for Wisdom Engineering, China Bandy Association, Guangdong Provincial Physical Fitness Association. Proceedings of the 10th China Conference on the Science of Physical Fitness Training (Volume II). Graduate School of Harbin Institute of Physical Education, 2023: 5. DOI: 10.26914/c.cnkihy.2023.064579.

[2] News from this publication. The National Health Commission and the National Working Committee on Aging have jointly released the "2021 National Report on the Development of the Aging Industry" [J]. Shanghai Nursing, 2022, 22(11):11.

[3] Suzuki T, Shimada H, Makizako H, et al. Effects of multicomponent exercise on cognitive function in older adults with amnestic mild cognitive impairment: a randomized controlled trial[J]. BMC neurology, 2012, 12: 1-9.

[4] Baker L D, Frank L L, Foster-Schubert K, et al. Effects of aerobic exercise on mild cognitive impairment: a controlled trial[J]. Archives of neurology, 2010, 67(1): 71-79.

[5] Li Duan Ying, Li Jie, Yang Qun et al. Research on Digital Monitoring of High-Level Athletes' Physical Training in the Big Data Era [J]. Journal of Guangzhou Sport University, 2021, 41(05):104-108. DOI:10.13830/j.cnki.cn44-1129/g8. 2021. 05. 023.

[6] Xie Jiawang. "Research on the Countermeasures for the High-Quality Development of Physical Fitness Training for the Elderly in China during the 14th Five-Year Plan Period" [C]// Physical Fitness Training Branch of the Chinese Society of Sports Science. Proceedings of the 8th China Physical Fitness Summit and the 2nd China Physical Fitness Training Annual Conference. [Publisher not specified], 2021:7. DOI:10.26914/ c. cnkihy.2021.065178.

[7] Deng Liang, Liu Yun. Development Status and Reflections on Physical Fitness Training for Children, Adolescents, and the Middle-aged and Elderly [J]. Innovation Research in Ice and Snow Sports, 2022(18):165-168.

[8] Wang Zhe, Huang Peng. Current Research Status of Physical Fitness Training for the Elderly [J]. Contemporary Sports Science and Technology, 2020, 10(31):120-122. DOI:10. 16655/ j.cnki.2095-2813.2003-5051-0792.

[9] Runge M, Rehfeld G, Resnicek E. Balance training and exercise in geriatric patients[J]. J Musculoskelet Neuronal Interact, 2000, 1(1): 61-65.

[10] Iwamoto,J.,Suzuki, H.,Tanaka, K.et al.Preventative effect of exercise against falls inthe elderly: a randomized controlled trial. Osteoporos Int 20, 1233–1240 (2009). http s://doi.org/10. 1007/ s00198-008-0794-9.

[11] Tan Aoqi. Research on the Evaluation of Trunk Flexibility in College Students Using Planar Photography Technique [D]. Beijing Sport University, 2015.

[12] Yao Lianqiang. The Influence of Baduanjin Exercise and Its Representation on the Cognitive Function of the Elderly [D]. Shandong University, 2023. DOI:10.27272/d.cnki. gshdu. 2023. 004900.

[13] Wang Xiaoqi. The Influence of Task Difficulty on the Fine Motor Control Process in the Elderly and Its Neural Mechanism [D]. Tianjin Normal University, 2023. DOI:10. 27363/ d.cnki.gtsfu.2023.000256.

[14] Li Duan Ying, Li Jie, Yang Qun et al. Research on Digital Monitoring of High-Level Athletes' Physical Training in the Big Data Era [J]. Journal of Guangzhou Sport University, 2021, 41(05):104-108. DOI:10.13830/j.cnki.cn44-1129/g8. 2021. 05. 023.