ISSN:2790-167X Volume-10-(2024)

Research on Strategies for Improving Key Technologies of Chinese Female Scientific Fitness

Yuxi Liu [1,a,*], Hongtao Ma [1]

[1] China Athletics Institute, Beijing Sport University, Beijing, 100084,China

[a,*] 643177290@qq.com

Abstract. In order to improve the scientific fitness level of women and connect with the National Fitness plan and the Healthy China strategy, this study analyzes the key technical components of scientific fitness for Chinese women and proposes corresponding improvement strategies.Research suggests that the current scientific fitness for women in China mainly includes three key technologies: theoretical research on health assessment and fitness guidance, development of integrated systems for health assessment and fitness guidance, and construction of a comprehensive intervention system for scientific fitness. The study proposes improvement strategies from five aspects: forming policy guarantees through the scientific fitness service system, intelligent sports development policies, and policies for promoting the integration of sports and medicine; forming organizational guarantees through the multi departmental collaborative mechanism led by sports and medical leaders, as well as participation mechanisms in various industries and social organizations; forming resource guarantees through complementary advantages and collaborative development of sports and medical industries; forming technical guarantees through the research and development of sports intelligent equipment and the operation of big data platforms；forming a talent guarantee through the cultivation of composite talents in sports and medicine, as well as the cultivation of fitness instructors.

Keywords: Scientific fitness; Key technologies; Enhancement strategy.

1. Introduction

Due to excessive unhealthy lifestyle habits, high work pressure, and decreasing physical activity, modern women face prominent health problems such as declining physical fitness, sub-health status, menopausal syndrome, and chronic diseases in the elderly. Currently, relying solely on traditional medical intervention is difficult to solve the female health crisis. The country and society have begun to pay attention to non medical proactive health measures that prioritize prevention to ensure women's health. The National Fitness Plan (2021-2025) [1] and the Outline of the Healthy China 2030 Plan[2] in the new era are leading documents for the development of China's scientific fitness industry. Women are identified as one of the key groups that need to strengthen scientific fitness guidance. With the support of national policies, various sectors of society should adopt interdisciplinary theories such as sports science, medicine, biology, and integrate computer technologies such as the Internet of Things, cloud computing, big data to jointly carry out research on key technologies for women's scientific fitness, solve key issues such as safety, effectiveness, and sustainability of women's fitness, and meet the personalized, precise, and scientific fitness needs of different types of women.

2. Definition of Key Technologies for Scientific Fitness

Based on the different perspectives of scholars such as Hu Yingqing[3], Zhao Riping[4], and Liu Qi[5] on the concept of scientific fitness, this study suggests that scientific fitness is under the guidance of fitness instructors, doctors, or exercise prescriptions, based on physical health monitoring, fitness monitoring data, and exercise risk assessment results, designing and implementing a safe, effective, systematic personalized and precise fitness guidance plan, to enhance personal concepts, attitudes, behaviors, skills in scientific fitness literacy and

achieve the goal of promoting coordinated physical and mental development, improving soci al adaptability, adapting to external environmental changes.The key technologies for women's scientific fitness are the critical technologies that meet the personalized, precise fitness nee ds of women, and improve the safety, effectiveness, sustainability of women's fitness.

3. Analysis of Key Technologies for Chinese Female Scientific Fitness

The "Healthy China 2030" Plan Outline points out the need to focus on the health iss ues throughout the female entire life cycle, in order to achieve higher national health levels. There are significant differences in the characteristics and methods of promoting health thr ough scientific fitness in different stages of female entire life cycle. Currently, female aware ness and demand for achieving the normalization of scientific fitness management are consta ntly increasing. The development of female scientific fitness requires the joint support of sp orts, medical care, and technology. Various fields should jointly research to break the conti nuous dynamic collection and multi-source fusion analysis technologies of health and exercis e data, establish a personalized，precise exercise prescription library for fitness guidance, cre ate a new scientific fitness guidance model that combines online network information platfor ms with offline comprehensive community sports centers.

3.1 Key Technologies for Scientific Theoretical Research on Female Health Assessment and Fitness Guidance

Guided by the concept of deep integration between national fitness and national health, s ports, biotechnology, medical and health fields should integrate scientific research capabilitie s, to explore the biological mechanisms of scientific fitness promoting health, establish ener gy consumption norms for physical activities, screen, evaluate and prevent the causes of spo rts injuries and accidents, develop measurement and evaluation standards of physical fitness for female different groups and effective exercise load evaluation methods and levels based on the above research, break the core key technology of establishing a female physical fitn ess and physical activity evaluation system.

(1)Exploring the biological mechanisms of female scientific fitness promoting health.The researches on the mechanism of promoting female health through scientific fitness in vario us countries have shown initial results, including female pregnancy health[6][7], perimenopausa l health[8][9], chronic disease prevention and control[10], mental health[11], exercise nutrition[12], and other aspects. In the future, The field of human sports science in China should contin ue to conduct in-depth research on the best models for improving female physical and ment al health, delaying aging, and preventing and controlling chronic diseases through scientific fitness at the cellular and molecular levels. This will be beneficial for developing scientific fitness programs for women throughout their entire life cycle, as well as for different profe ssions, living environments, and diseases, maximize the health improvement benefits for diff erent groups within a safe range.

(2)Establish a norm for energy expenditure in female physical activity. Developed count ries attach great importance to the establishment of energy consumption norms for physical activity. The United States has developed the Bright Future of Physical Activity and Health y Diet for young and underage women, which serves as an information guide for physical activity guidance and healthy diet for women of different age groups; Canada has develope d the Pregnancy Physical Activity Guidelines (2019) for pregnant women, becoming a presc ription for physical activity that shifts from improving quality of life to reducing pregnancy complications and optimizing the lifespan of two generations. There are differences in dail y physical activity and fitness participation behavior between Chinese and foreign female gr oups. Therefore, based on investigating and collecting common methods of Chinese female daily physical activity and sports fitness participation, China should accelerate the developm

ent of fitness exercise energy consumption norms suitable for different female groups, establ ish effective exercise loads and evaluation levels, and equip the Healthy China strategy with physical activity guidelines suitable for Chinese female groups.

(3)Research on risk Prevention and control management of female scientific fitness. Sp orts risk exists in real-time with the female scientific fitness process. After identifying and evaluating the causes of sports risk, we can effectively prevent or reduce the incidence of s ports risk events.In terms of preventing and controlling individual risk factors,, the occurren ce of risks related to female health, exercise ability, cognitive level, and other aspects can be reduced by strengthening research on screening and evaluating female health risk factors, as well as testing and evaluating their exercise abilities. In terms of preventing and control ling risks in sports conditions, governments, scientific research departments, professional coll eges, etc. can use modern information technology to open up formal channels for promoting scientific fitness, train social sports instructors on the theory of female scientific fitness, w hich is beneficial for women to receive safe and effective fitness guidance information on s ports project selection, exercise link design, exercise intensity and quantity arrangement. In t erms of preventing and controlling external environmental risks, China should conduct epide miological investigations on environmental pollution and exercise health among a large samp le population at different levels, to demonstrate the resistance mechanism of environmental pollution and physical activity on body health. In terms of risk prevention and control of s ports facilities, experts should discuss the development of hazard factor checklists and risk classification standards for various sports venues. The IT industry, sports industry, and other s can jointly develop AI identification, alarm, emergency systems and equipment for acciden ts such as drowning and sudden death to reduce the incidence of sports risks and enhance the timeliness of handling major sports risk accidents.

(4)Development of an evaluation system for women's physical fitness and physical activ ity. Currently, China should develop effective exercise load levels and evaluation methods f or different female groups based on the theoretical support of fitness promoting health mech anisms, energy consumption norms for physical activities, and exercise risk assessment. At t he same time, based on the five elements of physical health model, including body composi tion, cardiovascular endurance, psychological state, adaptability, and muscle strength, new in dicators and methods for evaluating the physical fitness of female different groups are scree ned or developed combined with health risk factors. By establishing a women's physical hea lth assessment system that focuses on physical activity assessment, it is possible to achieve continuous evaluation of the scientific fitness process, improve women's participation in fitne ss and physical activity levels. The development of female physical fitness and physical acti vity evaluation system should comprehensively cover different types of groups. Firstly, it ca n be divided into life cycle stages,[13] physiological cycle stages[14], and horizontally accordi ng to different professions and living environments. At the same time, attention should also be paid to special groups with chronic diseases, sub-health, and decreased physical abilitie s.

(5)Construction of a prescription library for female scientific fitness guidance. The ACS M Exercise Testing and Prescription Guidelines is a representative work of the latest resear ch results on international exercise prescription, but there are differences in the selection of fitness programs and methods between Chinese citizens and the United States. With the de epening of the concept of female active fitness to promote health, fields such as Chinese m edicine, sports science, and behavioral science should deeply integrate exercise prescriptions as a gathering point, actively explore various applicable exercise prescriptions with different purposes and the best results, and apply cloud computing and artificial intelligence technol ogy to promote the application of exercise prescriptions.At present, various related fields sh ould accelerate the analysis of the mechanisms of different exercise methods on female bod y metabolism regulation, cardiopulmonary function and sleep improvement, and physical fitn

ess enhancement, accurately measure physiological status, energy consumption and other par ameters under different exercise modes, develop a sports risk identification, evaluation and p revention system, and explore fitness methods and characteristic sports projects suitable for Chinese women. Based on the above theoretical support, experts and scholars should collect and analyze data on female physical fitness and physical activity, establish a personalized and accurate exercise prescription library tailored to different groups, living environments, a nd physical conditions of women.

3.2 Key Technologies for the Development of a Integration System for Female Health Assessment and Fitness Guidance

In view of the problems in the scientific process of female fitness and the widespread a pplication of mobile Internet of Things technology, efforts should be made to build a scient ific fitness network platform that integrates physical fitness and medicine. Based on the clo ud platform, the physical fitness and physical activity monitoring platform, exercise prescript ion database, and fitness guidance experts should be included in a recyclable system to pro vide personalized and precise guidance services for female online scientific fitness and healt h promotion.

（1）Physical fitness and physical activity monitoring platform. Currently, we should rely on the national physical fitness monitoring system to build a large database and cloud platf orm management system for monitoring female physical fitness and physical activity. Intelli gent APP software, smart wearable devices, and other mobile terminals can set up data rec ording programs based on life cycle and physiological cycle for women, providing more per sonalized physical fitness and physical activity monitoring and precise fitness guidance[15]. A t the same time, intelligent terminals can achieve reminder of external environmental risks, excessive exercise intensity, and intelligent warning of dangerous events such as swimming drowning and sudden death during exercise. （2）Sports prescription database. Under the ba ckground of technological development of "cloud, big, material, mobile and intelligent", spor ts prescription, as the core data resource for female sports to promote health, needs to be r ooted in the Internet and data platform. The sports prescription database should store the sp orts prescription content of all women in a standardized format. After receiving the analysis data from the physique and physical activity monitoring platform, utilize big data and mac hine learning algorithms to accurately match exercise prescription examples. For female fitne ss users with further personalized exercise prescription needs, exercise prescriptions can be i ssued by exercise prescribers through the guidance and communication platform. Exercise pr escribers can add new exercise prescription examples based on consultation and tracking res ults. （3）Guidance and communication platform. Due to individual differences among fitnes s enthusiasts, the fitness feedback provided by the fitness guidance system may not be entir ely suitable for each fitness enthusiast. Therefore, the fitness guidance network system must incorporate comprehensive consultation services that combine health and exercise provided by exercise prescribers, fitness guides, and medical experts for women. Based on personal e valuation data and expert cloud feedback, the fitness prescription goals and exercise environ ment should be revised to help fitness practitioners scientifically choose fitness projects and set the intensity, time, and frequency of exercise, more effectively guide subsequent fitness activities, avoid blind, casual exercise, reduce the occurrence of sports injury accidents, an d improve the effectiveness of fitness.

3.3 Key Technologies for Constructing a Comprehensive Intervention System for Female Scientific Fitness

The 2018 PAG2 applied the social ecological model theory to evaluate the effectiveness of national physical activity intervention, and adopted various forms of physical activity inte

rvention strategies at four levels: individual, social, communication environment, physical en vironment and policy, which played an effective role in increasing physical activity. Drawin g on the intervention model of the integrated ecology model in the United States, China ca n establish a comprehensive, multi-level, and wide-ranging female scientific fitness interventi on system. Scientific fitness intervention measures can be taken at the national policy, grass roots community, and personal network levels based on research achievements in scientific r esearch and modern information technology.

（1）At the national level, China should pay attention to special groups such as pregnant women, the elderly, disabled individuals, and chronic diseases, accelerate the development of fitness methods and design exercise prescriptions tailored to different groups of Chinese w omen. Based on this, a female fitness activity guide covering the entire population should b e formulated and issued in the form of national policies to achieve scientific fitness guidanc e for different groups of women. （2）At the community level, it is possible to rely on the integration system of female health assessment and fitness guidance, as well as the commu nity sports comprehensive service center, to achieve a combination of online and offline sci entific fitness guidance. All levels and departments should build intelligent comprehensive s ports venues centered around the community, equipped with physical fitness testing rooms, s ports function assessment rooms, sports skills recording rooms, expert online service rooms, etc. as hardware support for the network cloud platform. Fitness centers, social organizatio ns, fitness sites, community sports instructors, etc. can rely on modern venues to provide te rminal services, use professional means to upload more accurate physical and health data, a nd combine cloud sports prescriptions to provide face-to-face scientific fitness guidance and auxiliary services for women. （3）At the individual level, based on the increasing emphasi s of the country on mass sports, competitive sports service groups can expand their service targets to the general public, while strengthening the encouragement and support of familie s, friends, colleagues, and fitness instructors for female individuals, forming a social networ k for joint participation in scientific fitness, and creating a strong atmosphere of scientific f itness.

4. Strategies for Improving Key Technologies of Chinese Female Scientific Fitness

4.1 Policy Support Strategies

The improvement of key technologies for female scientific fitness is constrained by fou r factors: organizational management, cross industry resource integration, intelligent fitness p romotion systems, and human resources. To address these obstacles, it is necessary to have the support of national policies and regulations. The country can introduce systematic polici es or laws related to the integration of sports and medicine to promote female health. The focus is on establishing a system, emphasizing overall planning, and seeking practical result s[16] in policy formulation. It is necessary to strengthen the supervision and evaluation of th e implementation effect of policies and regulations, in order to obtain specific practical resu lts of sports and medicine integration. At the same time, appropriate financial subsidy polici es and service purchase policies should be formulated, and the social functions of female sc ientific fitness services should be entrusted to associations. Third parties should be introduce d as supervisors to achieve scientific and effective supervision.

4.2 Organizational Support Strategy

Chinese sports and medical industries are separated and their businesses are not integrat ed[17]. There is a lack of integration mechanisms between the two departments[18].The solutio n to promoting health issues through women's scientific fitness requires the establishment of

a collaborative management system among sports, medical departments, and related organizations. Firstly, senior government officials should guide the sports and medical departments to transform their government functions and break down the institutional and management barriers of cooperation between two departments in female scientific fitness[19]. Secondly, establish a multi departmental collaborative organization and resource sharing mechanism for women's scientific fitness services, in order to clarify the responsibilities of different management entities[20]. Thirdly, establish a multi departmental incentive, supervision, and evaluation mechanism to provide support and constraints for participating departments, organizations, enterprises, and individuals in female scientific fitness services. Fourthly, strengthen top-level participation in various industries and fields. The government should absorb the research achievements of scientific research institutions, introduce and mobilize more incremental resources to meet the scientific fitness service needs of different female consumer groups in the market, and transform the form of funding support for sports foundations. Fifthly, the government should strongly support the development of sports social organizations, steadily promote the decoupling of national sports associations, provide guidance and supervision, policy support, and financial subsidies for the entity of sports social organizations, develop and support community spontaneous female sports organizations, and thus broaden channels for women to participate in group fitness.

4.3 Resource Integration Strategy

The cross industry resource integration of female scientific fitness mainly involves the sports and medical industries, and their integration is the complementary and coordinated development of the two industries or systems. The resource integration of female scientific fitness mainly includes four parts: information, technology, human resources, and material resources, which are the conditions for solving the integration of the two industries. The integration of female scientific fitness information resources should develop a comprehensive platform for female sports and medical information, and construct complete electronic health records for women. The integration of female scientific fitness technology resources can establish sports and medical research institutes[21], promote interdisciplinary development, achieve the integration of sports and medical functions in improving women's physical health and preventing diseases, and solve the safety, effectiveness, and sustainability issues of female fitness[22]. The integration of female scientific fitness human resources mainly refers to the cooperation between sports and health experts and medical workers. A group of medical and sports experts is established to jointly diagnose and treat them for certain diseases, scientifically integrating the discourse power of doctors and sports experts, and exerting their huge influence on women's participation in sports[22]. The integration of female scientific fitness material resources mainly involves combining fitness resources with medical resources, establishing specialized sports medicine hospitals or adding sports medicine departments, and providing them with fitness equipment, medical equipment and other material resources through administrative intervention.

4.4 Intelligent Support Strategy

The implementation of intelligent female scientific fitness intervention should break down industry, project, and regional boundaries, build a sports big data collaborative operation mechanism, and establish an interconnected big data platform. Firstly, within the scope permitted by law, we need to innovate the methods of data collection and strengthen the development of software and hardware facilities for data collection. The intelligent sports industry should design and develop more smart sports terminal devices suitable for women, or increase efforts to build smart trails and smart squares, providing a data platform for scientific fitness for different female groups. The key to the intelligent development of female scientific fitness lies in the intelligent transformation of traditional sports goods and traditional sp

orts services, such as building digital and intelligent sports product factories, encouraging en terprises to strengthen investment in the research and development of intelligent sports prod ucts such as wearable devices for women, and establishing an intelligent scientific fitness e nvironment centered on female learners[23]. However, there are user data security risks and a lgorithmic discrimination in intelligent sports products[24]. Deep learning technology can be u sed to effectively reduce the negative effects of artificial intelligence[25], thereby achieving t he protection of female personal information and privacy.

4.5 Talent Support Strategy

Faced with the reality of lagging scientific fitness services for Chinese women, higher education institutions should strengthen interdisciplinary talent cooperation and training, estab lish a team of sports and medical integrated talents with high professional technical level a nd large scale, and an intelligent sports talent team with interdisciplinary backgrounds such as sports, mathematics, and computer science. Each community sports center should rely on universities and research units to strengthen cooperation with higher sports colleges and un iversities. Physical education teachers and students majoring in social sports should be allow ed to enter the community and participate in services such as female health assessment and fitness guidance not only enables students to gain practical experience, but also increases t he human resources for service supply. Experts should be organized to grassroots levels to provide guidance and training lectures on female scientific fitness from multiple perspectives and fields, and establish a long-term operational mechanism for the training of social sport s instructors. Retired athletes from sports schools and teams at all levels can be guided to j oin the group of social sports instructors to guide community women in scientific fitness. T his can not only solve the human resource problem of scientific fitness service supply, but also solve the problem of re employment of retired athletes.

5. Summary

With the increasing awareness of female active health and the promotion of scientific fit ness by national strategies, it is necessary to accelerate the research on the biological mech anisms of scientific fitness promoting health and the energy consumption norms of physical activity, the causes of sports risk should be screened, evaluated, prevented and controlled. Combined with the aforementioned research the core key technologies for establishing a per sonalized exercise prescription library and a system for evaluating female physical fitness an d physical activity should be broken through. This will provide theoretical support for the d evelopment of an integrated system for female health assessment and fitness guidance, as w ell as the establishment of a comprehensive intervention system for female scientific fitness.

References

[1] National Fitness Program (2021-2025) [N]People's Daily,2021-08-04 (001).

[2] The Central Committee of the Communist Party of China and the State Council have issued the "Healthy China 2030" Plan Outline[J].State Council Communique of the People's Republic of China,2016(32):5-20.

[3] Hu Yingqing.Analysis of Issues Related to Scientific Fitness Sports[J].Sports Journal,2003(01):63-66.

[4] Zhao Riping. Scientific research on mass fitness[J].Journal of Shenyang Institute of Physical Education,2007(02):41-43.

[5] Liu Qi,He Zhonghui.Scientific Fitness[M].Beijing:People's Sports Publishing House,2008.

[6] MAGRO-MALOSSO E R,SACCONE G,DI TOMMASO M,et al.,2017b. Exercise during pregnancy and risk of gestational hyper‐tensive disorders：a systematic review and meta- analysis[J].ActaObstet Gynecol Scand,96(8):921-931.

[7] Thangaratinam S,Rogozińska E,Jolly K,Glinkowski S,Duda W,Borowiack E,Roseboom T,Tomlinson J,Walczak J,Kunz R,Mol B W,Coomarasamy A,Khan K S. Interventions to reduce or prevent obesity in pregnant women: a systematic review.[J]. Health technology assessment (Winchester, England),2012,16(31).

[8] Ma Yinghua, Zhang Jingjing. The impact of physical exercise on menopausal syndrome in women[J].Chinese Journal of Sports Medicine,1991(02):114-115.

[9] Despres J.P.et al Loss abdominall fat and metabolic response to exercise training in obese women.Am J physical,1991,261:E159-167

[10] Wang Yu. Research progress on the mechanism of exercise in preventing tumor occurrence[J].Journal of Chengdu Sport University,2004(06):84-87.

[11] Yao Jiaxin,Sun Yanlin,Dai Qun,et al.The behavioral and biological mechanisms of aerobic exercise improving and promoting psychological benefits [A] Chinese Sports Science Society. Compilation of abstracts from the 11th National Sports Science Conference [C]. Chinese Sports Science Society: Chinese Sports Science Society,2019:3.

[12] Huang Bo,Deng Xiaoming.Research progress on the improvement of physical function through exercise nutrition[J].Food and fermentation technology,2018,54(03):89-92+100.

[13] Hua Keqin,Feng Youji.Practical Obstetrics and Gynecolog[M].People's Health Publishing House,2013.

[14] Feng Zhenwei,Wang Xianliang.Research on the Integration and Symbiosis Path Construction of Sports Industry and Medical Service Industry Based on Symbiosis Theory[J].Journal of Shandong Sport University,2018,34(05):1-7.

[15] Zhou Tong.Design and Research of an Intelligent Chronic Disease Health Management Service System Based on Mobile Terminals[D].Anhui University,2016.

[16] Russell R. Pate.An Inside View of the U.S. National Physical Activity Plan[J].Journal of Physical Activity and Health,2014,11(3).

[17] Feng Zhenwei, Wang Xianliang.Research on the Integration and Symbiosis Path Construction of Sports Industry and Medical Service Industry Based on Symbiosis Theory[J].Journal of Shandong Sport University,2018,34(05):1-7.

[18] Yang Jixing,Chen Jiaqi. Analysis of Constraints and Path Construction for the Integration of Sports and Medicine[J].Sports Culture Guide,2019(04):18-23.

[19] Zhang Kun,Yang Lina,Zhang Jiaxu.Healthy China: A Preliminary Exploration of the Model from "Integration of Sports and Medicine" to "Integration of Sports and Medicine"[J].Fujian Sports Science and Technology,2017,36(06):1-3+10.

[20] Feng Zhenwei,Han Leilei.Integration, Reciprocity, and Symbiosis: Exploring the Mechanism and Path of Symbiosis between Sports and Medical Health[J].Sports Science,2019,39(01):35-46.

[21] Zhang Yang,Wang Zhihong,Zhang Meng, Kang Yazhi, Wu Youliang. Research on the Service Demands, Constraints, and Development Strategies of Sports Medicine Integration in the Context of Healthy China: A Case Study of Hefei City[J].Journal of Shenyang Institute of Physical Education,2020,39(01):61-67+87.

[22] Guo Jianjun.Exploration of the Path of Promoting Health Revolution through the Integration of Sports and Medicine[J] Journal of Chronic Diseases,2017,18(11):1189-1192+1197.

[23] Zhang Yuanliang,Ping Jie.Comparative Study on Patent Strategies in the Sports Goods Industry between China and Foreign Countries-A Case Study of Sports Shoe Related Patent Data in the DII Database[J].China Sports Technology,2017,53(06):54-64.

[24] Ding Xiaodong.Algorithms and Discrimination: An Analysis of Algorithm Ethics and Legal Interpretation from the Perspective of the American Education Equality Case[J].Chinese and Foreign Law,2017,29(06):1609-1623.

[25] PARDAU, STUART L.1;EDWARDS, BLAKE.The FTC, the Unfairness Doctrine, and Privacy by Design: New Legal Frontiers in Cybersecurity[J].Journal of Business & Technology Law.2017,Vol.12(No.2)：227-276.