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 social adaptability, adapting to external environmental changes. The key technologies for women's scientific fitness are the critical technologies that meet the personalized, precise fitness needs 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 issues 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 through scientific fitness in different stages of female entire life cycle. Currently, female awareness and demand for achieving the normalization of scientific fitness management are constantly increasing. The development of female scientific fitness requires the joint support of sports, medical care, and technology. Various fields should jointly research to break the continuous dynamic collection and multi-source fusion analysis technologies of health and exercise data, establish a personalized, precise exercise prescription library for fitness guidance, create a new scientific fitness guidance model that combines online network information platforms 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, sports, biotechnology, medical and health fields should integrate scientific research capabilities, to explore the biological mechanisms of scientific fitness promoting health, establish energy consumption norms for physical activities, screen, evaluate and prevent the causes of sports 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 fitness 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 various countries have shown initial results, including female pregnancy health[6][7], perimenopausal 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 continue to conduct in-depth research on the best models for improving female physical and mental 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 professions, living environments, and diseases, maximize the health improvement benefits for different groups within a safe range.

(2) Establish a norm for energy expenditure in female physical activity. Developed countries 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 Healthy 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 developed the Pregnancy Physical Activity Guidelines (2019) for pregnant women, becoming a prescription 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 daily physical activity and fitness participation behavior between Chinese and foreign female groups. Therefore, based on investigating and collecting common methods of Chinese female daily physical activity and sports fitness participation, China should accelerate the development of scientific technologies for female health assessment and fitness guidance.
ent of fitness exercise energy consumption norms suitable for different female groups, establish 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. Sports 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 sports risk events. In terms of preventing and controlling individual risk factors, the occurrence 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 controlling risks in sports conditions, governments, scientific research departments, professional colleagues, 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, which is beneficial for women to receive safe and effective fitness guidance information on sports project selection, exercise link design, exercise intensity and quantity arrangement. In terms of preventing and controlling external environmental risks, China should conduct epidemiological investigations on environmental pollution and exercise health among a large sample 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 sports 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 sectors can jointly develop AI identification, alarm, emergency systems and equipment for accidents 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 activity. Currently, China should develop effective exercise load levels and evaluation methods for different female groups based on the theoretical support of fitness promoting health mechanisms, energy consumption norms for physical activities, and exercise risk assessment. At the same time, based on the five elements of physical health model, including body composition, cardiovascular endurance, psychological state, adaptability, and muscle strength, new indicators and methods for evaluating the physical fitness of female different groups are screened or developed combined with health risk factors. By establishing a women's physical health 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 fitness and physical activity levels. The development of female physical fitness and physical activity evaluation system should comprehensively cover different types of groups. Firstly, it can be divided into life cycle stages, physiological cycle stages, and horizontally according 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 abilities.

(5) Construction of a prescription library for female scientific fitness guidance. The ACSM Exercise Testing and Prescription Guidelines is a representative work of the latest research 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 deepening of the concept of female active fitness to promote health, fields such as Chinese medicine, 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 technology to promote the application of exercise prescriptions. At present, various related fields should accelerate the analysis of the mechanisms of different exercise methods on female body metabolism regulation, cardiopulmonary function and sleep improvement, and physical fitness.
ess enhancement, accurately measure physiological status, energy consumption and other parameters under different exercise modes, develop a sports risk identification, evaluation and prevention 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, and 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 application of mobile Internet of Things technology, efforts should be made to build a scientific fitness network platform that integrates physical fitness and medicine. Based on the cloud platform, the physical fitness and physical activity monitoring platform, exercise prescription database, and fitness guidance experts should be included in a recyclable system to provide personalized and precise guidance services for female online scientific fitness and health 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 platform management system for monitoring female physical fitness and physical activity. Intelligent APP software, smart wearable devices, and other mobile terminals can set up data recording programs based on life cycle and physiological cycle for women, providing more personalized physical fitness and physical activity monitoring and precise fitness guidance[15]. At 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 background of technological development of "cloud, big, material, mobile and intelligent", sports prescription, as the core data resource for female sports to promote health, needs to be rooted in the Internet and data platform. The sports prescription database should store the sports 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 machine learning algorithms to accurately match exercise prescription examples. For female fitness users with further personalized exercise prescription needs, exercise prescriptions can be issued by exercise prescribers through the guidance and communication platform. Exercise prescribers can add new exercise prescription examples based on consultation and tracking results. (3) Guidance and communication platform. Due to individual differences among fitness enthusiasts, the fitness feedback provided by the fitness guidance system may not be entirely 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 evaluation data and expert cloud feedback, the fitness prescription goals and exercise environment 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, and 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
Intervention strategies at four levels: individual, social, communication environment, physical environment and policy, which played an effective role in increasing physical activity. Drawing on the intervention model of the integrated ecology model in the United States, China can establish a comprehensive, multi-level, and wide-ranging female scientific fitness intervention system. Scientific fitness intervention measures can be taken at the national policy, grassroots community, and personal network levels based on research achievements in scientific research 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 women. Based on this, a female fitness activity guide covering the entire population should be formulated and issued in the form of national policies to achieve scientific fitness guidance 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 community sports comprehensive service center, to achieve a combination of online and offline scientific fitness guidance. All levels and departments should build intelligent comprehensive sports venues centered around the community, equipped with physical fitness testing rooms, sports function assessment rooms, sports skills recording rooms, expert online service rooms, etc. as hardware support for the network cloud platform. Fitness centers, social organizations, fitness sites, community sports instructors, etc. can rely on modern venues to provide terminal services, use professional means to upload more accurate physical and health data, and 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 emphasis 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 families, friends, colleagues, and fitness instructors for female individuals, forming a social network for joint participation in scientific fitness, and creating a strong atmosphere of scientific fitness.

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 four factors: organizational management, cross industry resource integration, intelligent fitness promotion 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 policies 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 results in policy formulation. It is necessary to strengthen the supervision and evaluation of the implementation effect of policies and regulations, in order to obtain specific practical results of sports and medicine integration. At the same time, appropriate financial subsidy policies and service purchase policies should be formulated, and the social functions of female scientific fitness services should be entrusted to associations. Third parties should be introduced 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 integrated. There is a lack of integration mechanisms between the two departments. The solution 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\textsuperscript{[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\textsuperscript{[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\textsuperscript{[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\textsuperscript{[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\textsuperscript{[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 enterprisesto strengthen investment in the research and development of intelligent sports products such as wearable devices for women, and establishing an intelligent scientific fitness environment centered on female learners\textsuperscript{[23]}. However, there are user data security risks and algorithmic discrimination in intelligent sports products\textsuperscript{[24]}. Deep learning technology can be used to effectively reduce the negative effects of artificial intelligence\textsuperscript{[25]}, thereby achieving the 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, establish a team of sports and medical integrated talents with high professional technical level and 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 universities. Physical education teachers and students majoring in social sports should be allowed 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 the 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 sports instructors. Retired athletes from sports schools and teams at all levels can be guided to join the group of social sports instructors to guide community women in scientific fitness. This 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 fitness by national strategies, it is necessary to accelerate the research on the biological mechanisms 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 personalized exercise prescription library and a system for evaluating female physical fitness and physical activity should be broken through. This will provide theoretical support for the development of an integrated system for female health assessment and fitness guidance, as well as the establishment of a comprehensive intervention system for female scientific fitness.

References


