

Principles and Practical Methods for Preventing Sports Injuries in Fitness Activities

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ABSTRACT

Against the backdrop of the deepening of the national fitness strategy, the enthusiasm for participation in public fitness continues to rise, and the size of the sports population is expanding year by year. However, the problem of sports injuries is also becoming increasingly prominent, which not only affects the continuity of fitness plans, but some acute injuries may also cause irreversible joint function impairment, becoming an important obstacle to the high-quality development of national fitness. Based on the clinical practice results and authoritative monitoring data of sports medicine, this article clarifies the core principles of sports injury prevention in fitness activities, systematically sorts out the practical paths of key dimensions such as individual adaptation assessment, scientific exercise planning, and standardized technical execution, and addresses the differentiated protection needs of the ordinary fitness population and special populations such as the elderly and those with chronic diseases. Related studies have confirmed that strict implementation of scientific prevention measures can reduce the incidence of fitness-related sports injuries by over 40%. The research results of this article aim to provide practical preventive guidance for the fitness population and professional instructors, as well as provide reference for fitness institutions to develop safety training standards, and facilitate the safe and effective development of national fitness activities.

KEYWORDS

Fitness activities; Sports injuries; Prevention principles; Practical methods; Safe Fitness

1. INTRODUCTION

The "2024 National Fitness Activity Status Survey Report" released by the General Administration of Sport of China shows that the proportion of people who regularly participate in sports and fitness in China has reached 38.5%, an increase of 6.2 percentage points from 32.3% in 2020. The atmosphere of national fitness is becoming increasingly strong, and diverse fitness scenarios such as gym training, outdoor jogging, and home yoga have been integrated into people's daily lives. However, with the expansion of the fitness population and the diversification of sports scenarios, the problem of sports injuries has become increasingly prominent. According to the "Sports Injury Monitoring Report for Fitness Population" released by the Chinese Society of Sports Medicine in 2024, nearly 60% of fitness participants have experienced varying degrees of sports injuries, among which muscle strains, joint sprains, and ligament injuries account for more than 70% in total. The joint injury rate of the elderly fitness group and the muscle strain rate of the youth group are 18% and 12% higher than the average level, respectively. Through in-depth analysis of the causes of injury, it was found that the main risk factors include mismatched exercise intensity and individual abilities, non-standard technical movements, missing or insufficient warm-up procedures, and improper selection of exercise equipment [1]. Sports injuries not only force the interruption of fitness plans, but in severe cases may

also cause long-term sequelae such as chronic pain and joint function degeneration, which not only damage the physical health of participants, increase personal medical burden, but also consume limited social medical resources and restrict the improvement of the quality of national fitness. In this context, clarifying the prevention principles of sports injuries in fitness activities and building a scientifically sound practical prevention and control system based on the physiological characteristics of different populations is of great practical value for ensuring fitness safety and consolidating the foundation for the development of national fitness. This article combines existing research conclusions in sports medicine with practical experience in frontline fitness guidance to systematically explore prevention strategies for sports injuries, providing scientific guidance for the general fitness population and professional guidance personnel.

2. SCIENTIFICALLY EVALUATE INDIVIDUAL FOUNDATIONS AND ACCURATELY MATCH EXERCISE INTENSITY

The differences in individual basic physical conditions are the core variables that induce sports injuries, and scientifically evaluating individual adaptability and matching exercise intensity is the primary prerequisite for preventing sports injuries. According to monitoring data from the Chinese Society of Sports Medicine in 2024, individuals who engage in fitness blindly without conducting individual assessments have a 52.3% higher incidence of injuries compared to those who undergo systematic assessments. In practical operation, individual assessment needs to focus on three core dimensions: first, basic health assessment, relying on physical examination reports to verify cardiovascular function, bone and joint health, metabolic indicators, etc., and clarify fitness taboos, such as avoiding high-intensity squats, stair climbing, hill climbing and other exercises that increase joint load for people with degenerative knee joint disease [2]; The second is physical fitness level assessment, covering indicators such as cardiovascular endurance and muscle strength. Methods such as 6-Minute Walk Test (6MWT), 1RM test, and sitting forward bend test can be used. For adult female beginners, if the upper limb 1RM is less than 50% of their body weight, low-intensity training such as resistance band training and manual pushing should be prioritized to solidify the foundation before advancing; The third is to conduct background research on sports, understand participants' past sports experiences, injury history, sports frequency, etc., accurately identify risk points, and avoid triggering old injuries repeatedly.

In the process of matching exercise intensity, it is necessary to follow the principle of "target intensity adaptation" and use the heart rate reserve method to calculate the appropriate exercise intensity. The formula is: target heart rate = (maximum heart rate – resting heart rate) × exercise intensity percentage + resting heart rate [3]. It is recommended that the intensity of the regular healthy adult fitness population be controlled within the 40%–60% heart rate reserve range, taking into account both fitness effectiveness and injury prevention. Special populations such as the elderly, chronic disease patients, and postoperative rehabilitation patients need to be evaluated by clinical doctors or professional guidance personnel to reduce their intensity by 10%–15% and exercise in a low-intensity, high-frequency mode to avoid cardiovascular accidents or joint injuries caused by excessive intensity.

3. ADHERE TO THE PRINCIPLE OF GRADUAL PROGRESS AND CONSTRUCT A REASONABLE SYSTEM FOR ADVANCING SPORTS

Gradual progression is the core principle of sports training, and it is also a key approach to reduce the risk of fitness injuries. In fitness practice, some participants are eager to achieve results and significantly increase their exercise load in a short period of time, which can easily lead to excessive fatigue of soft tissues such as muscles and ligaments, thereby increasing the risk of injury geometrically. According to the 2023 fitness population tracking study by China Sport Science and Technology, when the exercise load increases by more than 10% per week, the injury incidence rate

can reach as high as 37.8%; The population with load increase controlled at 5%–8% has an injury incidence rate of only 8.2% [4]. This data fully confirms the core value of the principle of gradual progression, which needs to run through the entire process of progression in the three dimensions of exercise duration, intensity, and frequency, forming a systematic progression logic.

Specifically, the progression of exercise can be divided into three core stages: the first is the introductory adaptation stage (1-4 weeks), with the core goal of cultivating exercise habits and improving exercise adaptability. Priority should be given to ensuring stable exercise frequency, with a recommended 3-4 times a week and a single session lasting 30-45 minutes. The intensity should be mainly medium to low, and low-risk activities such as brisk walking, jogging, and manual exercise can be selected; The second stage is the ability improvement stage (5-12 weeks). After the body adapts to the basic load, the training difficulty can be gradually increased. The exercise load (duration × intensity) can be increased by 5%–8% per week, while increasing the complexity of movements, such as transitioning from manual training to lightweight equipment training, and from single-movement training to compound-movement training; The third stage is the stable maintenance phase (after 12 weeks), in which the load is maintained or adjusted according to the body's adaptation, avoiding unlimited pursuit of intensity improvement, and focusing on consolidating the fitness effect. In addition, to avoid the accumulation of chronic fatigue, a "buffer adjustment period" should be set up during the advanced process. It is recommended to schedule a low-load training week every 4 weeks, reducing the load by 30%–50%, providing sufficient repair time for muscles and ligaments, and reducing the risk of chronic injury from the source [5]. For special projects such as strength training, it is necessary to follow the principle of "proficiency in movements takes priority over load improvement", ensure standardized movements and correct force patterns, and then gradually increase weight to avoid compensatory injuries caused by movement deviations.

4. STANDARDIZE EXERCISE TECHNIQUES AND STRENGTHEN THE STABILITY OF CORE MUSCLE GROUPS

Irregular technical movements are the primary cause of fitness-related injuries. According to clinical statistics from the **Chinese Journal of Sports Medicine** in 2024, about 45% of fitness-related injuries are directly related to technical movement errors [6]. Typical incorrect movements can easily trigger injuries, such as knee adduction during squats, which can lead to compression injury of the medial meniscus of the knee joint; During push-ups, if the chest and waist collapse, it can suddenly increase the pressure on the lumbar intervertebral disc, increase the load on the shoulder joint tendons, and induce problems such as lumbar disc herniation and rotator cuff injury. Therefore, standardizing exercise techniques and strengthening the stability of core muscle groups are the core practical directions for improving injury prevention effectiveness and key links to ensuring fitness safety.

At the practical level of technical specifications, it is necessary to establish a core understanding of "prioritizing the mastery of basic movements". Fitness beginners should abandon the erroneous mentality of "pursuing difficulty" and start with basic movements such as standard squats, plank supports, lunges, and manual pushing. Under the guidance of certified social sports instructors, they should correct the details of the movements, establish the correct muscle activation pattern, and form muscle memory. Taking squats as an example, the correct movement essentials include: feet shoulder-width apart or slightly wider, toes slightly outward by 15°–30°, hip joint actively flexes first during squatting, knees naturally bend along the direction of toes, avoiding inward buckling or excessive exceeding of toes, while core muscles continue to tighten, keeping the trunk upright, avoiding hunching the chest and rounding the back, in order to balance joint stress and reduce the risk of injury. The core muscle groups, as the "central system" that maintains the stability of physical movement, have insufficient strength or weak control ability, which can easily lead to compensatory movement and subsequently cause injury. Based on this, it is necessary to integrate core training into daily fitness plans. It is recommended to schedule 2-3 specialized core training sessions per week, selecting classic

movements such as plank support, hip bridge, dead worm style, bird dog style, etc. The duration of each training session should be controlled at 15-20 minutes, gradually improving the endurance and control stability of the core muscle groups. According to research data from the *Journal of Beijing Sport University* in 2023, the incidence of fitness-related joint injuries in the fitness population who underwent standard core training for 8 weeks decreased by 28.6% compared to the untrained population, fully verifying the role of core training in injury prevention [7].

5. PAY ATTENTION TO WARM-UP AND RELAXATION ACTIVITIES, ACTIVATE MUSCLE PROTECTION MECHANISMS

Insufficient warm-up and inadequate relaxation after exercise are common problems among the fitness population. Such behaviors can lead to insufficient elasticity of muscles and ligaments, poor blood circulation, decreased flexibility and coordination of muscles and joints during exercise, and a significant increase in the incidence of acute injuries such as strains and sprains. The 2024 survey on injury causes among the fitness population by the Chinese Society of Sports Medicine showed that the incidence of acute injuries among those who exercise without warming up is 3.2 times higher than that of those who fully warm up [8]; People who do not relax after exercise have delayed-onset muscle soreness (DOMS) that lasts more than 40% longer than those who relax regularly, and their risk of chronic strain injury increases by 23%. It can be seen that emphasizing and standardizing the implementation of warm-up and relaxation activities, activating the protective mechanisms of muscles and joints, is a key link in the prevention system of sports injuries.

When implementing the warm-up phase, it is necessary to follow the core principle of "dynamic warm-up as the mainstay, static stretching as a supplement", and avoid prolonged static stretching before exercise to prevent affecting muscle contraction ability [9]. The recommended duration for a single warm-up is 10-15 minutes, which is divided into three core modules: the first is the joint activity module, covering the main joints such as shoulder, elbow, wrist, hip, knee, ankle, etc., to move the joint capsule and ligaments through circumduction, flexion and extension movements, with each joint moving for 30 seconds to improve joint mobility; The second is the dynamic stretching module, which selects high-knee lifts, lunges, arm wraps, torso twists and other movements, completing 15-20 times each to improve muscle elasticity and blood circulation rate; The third is the neural activation module, which uses low-load explosive movements such as low-intensity jumping, heel lifting, and rapid high leg lifting to activate muscle neural control pathways and improve muscle response speed and coordination during exercise. After exercise, a combination of "static stretching and fascial relaxation" mode should be used for relaxation, with a single session duration controlled at 10-15 minutes. Static stretching is aimed at the main muscle groups that exert force during exercise, such as pectorals, latissimus dorsi, quadriceps femoris, hamstrings, etc. Each movement should be maintained for 30 seconds, and the stretching intensity should be set to a mild stretch to avoid muscle damage caused by excessive stretching; Fascia relaxation can use tools such as foam rollers and fascia guns to slowly roll and relax muscle-tightened areas, alleviate muscle tension and fatigue, facilitate the elimination of metabolic waste, and accelerate body recovery.

6. DYNAMICALLY MONITOR THE EXERCISE STATUS AND ADJUST THE EXERCISE PLAN IN A TIMELY MANNER

Fitness activities are a continuous and dynamic process, and an individual's physical state is constantly fluctuating due to factors such as fatigue accumulation, nutrient intake, sleep quality, and environmental changes, directly leading to changes in the body's tolerance to sports injuries. Therefore, real-time dynamic monitoring of physical condition and timely adjustment of exercise plans based on monitoring results are the core guarantees for building a dynamic injury prevention system. The actual monitoring needs to establish a dual monitoring system of "subjective

perceptions+objective indicators" to ensure comprehensive and accurate results: subjective perceptions monitoring includes muscle soreness, joint discomfort, overall fatigue, etc., recorded daily using a 1-10-point quantitative scoring method, and a score exceeding 6 points indicates that the body is in a state of high load [10]; Objective indicator monitoring focuses on key indicators such as resting heart rate, recovery time of heart rate after exercise, and daily sleep duration. Clinical practice has shown that if the resting heart rate increases by more than 10 beats per minute compared to daily levels, or if the heart rate recovers for more than 10 minutes after exercise, it indicates excessive physical fatigue and requires timely intervention.

The adjustment strategy for monitoring results should be both targeted and practical, avoiding blind adjustments: if mild muscle soreness is found during monitoring (score 3-4), the current intensity can be maintained, the duration of a single exercise can be shortened by 10-15 minutes, and the rest interval can be increased; If there is joint discomfort or mild pain (scored 5-6 points), immediately pause the movements that worsen the discomfort and switch to low-impact rehabilitation training such as swimming, yoga, Pilates, etc. Wait until the symptoms are relieved before gradually resuming training; If there is persistent fatigue, pain score exceeding 7 points, or resting heart rate continues to rise, it is necessary to arrange 1-2 days of complete rest, optimize dietary structure, supplement high-quality protein and complex carbohydrates, ensure 7-8 hours of sleep per day, and promote physical function recovery. In addition, it is recommended for long-term members of the fitness population to undergo a comprehensive physical assessment every 3 months, and optimize their exercise plan based on the assessment results. For example, increasing intensity moderately as physical fitness improves, and supplementing weak muscle groups for imbalanced muscle strength training [11]. If there are signs of acute injury during exercise, such as sudden severe pain, restricted limb movement, local swelling, etc., it is necessary to strictly follow the principle of "stopping exercise - resting in place - applying local cold compress - seeking medical attention in a timely manner" to avoid aggravating the injury.

7. CONCLUSION

The prevention of sports injuries in fitness activities is not a single-component undertaking, but a multidimensional and collaborative systematic undertaking. The five core principles of scientific evaluation, gradual progress, technical specifications, warm-up and relaxation, and dynamic monitoring are interrelated and mutually supportive, forming a complete injury prevention system. In practical fitness practice, by accurately implementing individual adaptation assessment and matching exercise intensity, constructing a phased scientific advanced system, standardizing basic technical movements, strictly implementing warm-up and relaxation processes, establishing dynamic monitoring and program adjustment mechanisms, the probability of sports injuries can be reduced from the source, providing strong guarantees for the safety and sustainability of fitness activities.

The existing authoritative monitoring data and clinical research results have confirmed that strictly implementing the above prevention principles and practical methods can reduce the incidence of sports injuries among the fitness population by more than 40%, while improving the pertinence and effectiveness of fitness training and enhancing the exercise experience. From the perspective of high-quality development of national fitness, it is still necessary to further strengthen the scientific fitness awareness of the fitness population in the future, increase the supply of professional guidance, promote the popularization and dissemination of scientific injury prevention knowledge, and help the transformation of national fitness activities from "extensive participation" to "safe and scientific participation". For professional fitness instructors, it is necessary to enhance individual differentiated guidance abilities and develop personalized injury prevention plans based on different age groups, health conditions, and physical fitness levels; For the majority of fitness participants, it is necessary to establish the "prevention first" fitness concept, actively learn scientific fitness knowledge, abandon blind training behavior, and regulate their own exercise habits. Only by forming a collaborative force

of "professional guidance+individual practice" can we effectively solve the problem of fitness injuries and lay a solid safety foundation for the deepening of the national fitness strategy.

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