

Strategies for Core Strength Training in Free Combat Teaching

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Abstract: Since free combat is a competitive sport that flexibly utilizes kicking, punching, wrestling, and holding techniques to defeat the opponent, a good core strength of athletes can help to improve the technical level, enhance the quality of movements, and protect the joints and muscles. In order to carry out core strength training in free combat teaching with high quality, firstly, it is necessary for coaches to carry out simple training, centralized training, and extended training according to the basic planning of adaptation-stabilization-improvement. Secondly, it is also important to test the athlete's physical and athletic qualities before implementing the specific training plan, optimize the training program, and carry out statistical analysis of the stage training data in order to achieve the best training effect.

Keywords: Free combat teaching; Core strength training; Strategy

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1. Introduction

The development and progress of the times have promoted the popularization of modern competitive sports. As a modern competitive sport with strong ornamental and confrontational qualities, free combat puts high requirements on athletes' strength, speed, balance stability, and movement aesthetics ^[1]. Therefore, there are many theoretical and practical studies related to the sport of free combat. In particular, they studied how to complete the whipping and other actions in free combat with high quality through the training of the muscle strength of the abdominal, hip, and back. These studies undoubtedly provide guidance and reference for core strength training in the teaching of college free combat, and require college free combat teachers to develop and implement training programs suitable for the athletes based on the actual situation, and help them steadily improve their competitive level ^[2].

2. The importance of core strength in free combat

2.1. Stabilizing the center of gravity and improving the technical level

In free combat training and competitions, variations in fist and leg strength are common. When power is

generated, the rotation of the body driven by the waist often results in shifts in the athlete's center of gravity. If the center of gravity becomes unstable, it can alter the trajectory of punches and kicks, thereby affecting the quality of technical performance. Systematic core strength training enhances the contraction and stability of the abdominal, back, and hip muscles, allowing athletes to maintain better control over their center of gravity. This control ensures balanced muscle group coordination during force exertion ^[3], leading to improved quality in both isolated and combined muscle movements. Ultimately, this contributes to enhanced athletic performance.

2.2. Building up power transmission and improving the quality of movement

Free combat sports demand athletes to make swift and adaptable movements, such as continuous lateral flash steps, which rely on the body's core as the central power source. These actions essentially involve the transmission of force through a kinetic chain, where the core muscles play a pivotal role in storing and channeling energy. High-quality core strength training ensures stable and efficient energy transfer, starting from the proximal torso and progressing through the core muscle group. Each muscle in the chain connects tightly, often spanning multiple joints, to transmit force to the distal segments of the limbs. This process completes the kinetic chain, allowing for more efficient movement and better final motion quality. As a result, athletes achieve enhanced performance, characterized by precision and power in their movements ^[4].

2.3. Protecting joints and muscles and preventing sports injuries

Free combat sports are fast-paced and highly confrontational, often leading to joint and muscle injuries during training and competitions. Enhancing core strength can significantly fortify core muscle groups, including the lumbar and abdominal muscles, scapular muscles, biceps, and biceps femoris, increasing their rigidity. This improved muscular robustness serves two primary purposes: first, it enhances the body's ability to withstand external impacts, offering greater resistance against strikes; second, it effectively dissipates external forces, preventing them from transmitting inward and thereby safeguarding joints, muscles, and internal organs. Consequently, athletes can experience a substantial reduction in injury risk during training and competition.

3. The basic planning of core strength training in free combat teaching

3.1. Adaptation phase

Horizontal comparisons reveal significant differences in the physical qualities and core muscle strength among various free combat athletes, while longitudinal comparisons show variability in the quality of core muscle engagement for different free combat movements by the same athlete. Therefore, core strength training should adopt a progressive, ladder approach tailored to individual needs. This begins with pre-adaptive, simple exercises to help athletes maintain a controlled imbalance, maximizing core muscle stimulation.

During the acclimatization phase, spanning approximately two weeks, the focus is on unarmed and basic limb movements. The goal is to help athletes experience core muscle contraction and expansion while improving spinal and pelvic stability, thereby enhancing body control and balance. Training exercises at this stage include single-arm or single-leg overhead bridges, supine hip thrusts, and ipsilateral overhead bridges. Each exercise is performed in two sets lasting 30 seconds each ^[5], with an emphasis on maintaining hip and pelvic stability and synchronizing movement with controlled breathing. Coaches monitor training loads by assessing the athlete's endurance in prone bridges and similar positions, evaluating movement quality through posture stability and adjusting the intensity as needed. This tailored guidance ensures effective training progress and optimal core development ^[6].

3.2. Stabilization phase

Once the athlete has established an understanding of the core muscle group's power points and activation states, the next phase involves a stabilization period lasting no less than two weeks. This phase is designed to further stimulate deep core muscle groups, enhancing balance, stability, and control. During this period, training incorporates equipment such as yoga balls, gymnastic balls, balance boards, and dumbbells to increase the complexity and intensity of exercises. The training regimen may include exercises such as yoga ball foot-supported supine hip lifts, balance board single-leg supports, gymnastic ball V-ups, and dumbbell punching drills. Warm-up exercises like side bridges, back bridges, and ipsilateral leg-arm dip bridges are performed in four sets of approximately 40 seconds each. More advanced exercises using unstable equipment also follow a four-set structure, lasting 40–45 seconds per set. For athletes demonstrating proficiency, additional weight training, like balance board single-leg stretches or yoga ball V-ups with added resistance, can be introduced, maintaining the same set and repetition structure.

Coaches play a crucial role in ensuring correct execution. They must pre-plan sets, repetitions, and durations, and provide clear demonstrations of each exercise. For instance, when performing dumbbell punches, athletes should adopt a practical stance and alternate between prescribed sets of punches and hooks with both hands. Coaches should observe athletes systematically using both visual assessments and instruments to ensure proper form, such as ensuring the athlete's body sinks correctly when performing single-leg supports on a balance board. They should also monitor training loads to decide whether to increase exercise difficulty or adjust training durations for individual athletes^[7]. Throughout the stabilization period, dual methods of counting and timing are used to guide athletes, helping them maintain proper form and complete the prescribed training while adjusting intensity as needed.

3.3. Improvement phase

After establishing a solid foundation with both unarmed and armed core strength exercises, athletes can progress to steady-state integrated and complex core strength training. This phase, typically lasting about two weeks, aims to enhance the perception of the body as a unified system through intensified unstable and stability-oriented exercises. The primary focus is to improve neural control over balance and stability, building upon the muscle control developed in earlier stages. Key exercises at this stage include balancing on a board while holding a lead ball with one leg bent, kneeling on a yoga ball while turning with a lead ball, and pressing a yoga ball against the back while holding a lead ball behind the neck.

Due to the higher intensity and complexity of this phase, warm-ups lasting no less than 30 minutes are essential. Warm-up exercises may include advanced bridging techniques such as the 8-level bending bridge, single-leg double-elbow bending bridge, and single-arm double-leg bending bridge, performed in six sets of 60 seconds each. During the main training session, unstable equipment weight exercises are performed in two sets of 25 repetitions, each lasting 30 seconds, with at least a one-minute rest between sets. Coaches should adjust the training plan in real time based on timing and counting metrics, as well as the athlete's breathing patterns and focus levels. After completing the workout, muscle stretching and massage relaxation exercises should be conducted to enhance recovery and reduce the risk of injury. This systematic approach ensures athletes build comprehensive core strength and coordination, supporting optimal performance in competitive environments^[8].

4. The implementation method of core strength training in free combat teaching

4.1. Athletes' sports and physical quality test

To ensure the successful implementation of a core strength training program, effective communication with free combat teachers and coaches is essential. This involves using instruments and equipment to assess athletes' physical fitness and sports performance, providing a solid and accurate basis for creating tailored training programs.

The testing process typically includes organizing test personnel, explaining test precautions, calibrating instruments, and preparing athletes with a warm-up and skin preparation. Specific steps include applying iodine to the skin, attaching electronic sensors and electromagnetic blocks to designated areas, and conducting two types of punches: straight fist and flagellate punches. These actions allow for the collection and analysis of comprehensive data. Equipment used in the process includes an isokinetic testing system to measure muscle strength, a multifunctional force target to gather impact data, and a wireless surface electromyograph (sEMG) to assess the force rate during impact. Key test metrics encompass isometric force, strike effect, and surface EMG parameters. These include 60°/sec measurements of abdominal, dorsal, and hip muscles, peak extension torque, maximum relative striking force, and sustained contraction metrics of muscles like the rectus abdominis and external obliques.

For isometric testing, slow and fast contractions of flexor and extensor muscles are evaluated in three repetitions per mode, with a two-minute rest between sets. During striking effect assessments, athletes warm up before executing consecutive strikes on a force-measuring target upon instruction. sEMG data collection requires recording the maximum and active contraction forces of core muscles, followed by continuous data acquisition after warm-up. This structured approach ensures precise data collection, enabling the design of an effective, evidence-based training program.

4.2. Individualized training program development and application

After evaluating the athlete's physical and athletic performance metrics, the coach should develop a personalized training plan tailored to the characteristics of free combat, as well as the athlete's prior competition results and training history.

For instance, if an athlete demonstrates average core muscle strength and body stability, with limited capacity to manage high-load or complex training, the coach can implement a two-phase traditional core strength training program. The first phase focuses on building muscle strength and enhancing stability. Daily exercises include planks, supine leg lifts, and single-leg side-lying lifts. Each workout involves three sets of each exercise, with each set lasting 30 seconds and 30 seconds of rest between sets. Athletes train three times a week, ensuring a rest day between sessions. The second phase emphasizes developing explosive power. Daily exercises include ribbed wood leg lifts, dumbbell lateral raises, and barbell rotations. Similarly, these workouts consist of three sets per exercise, with 16 repetitions per set and a 30-second rest between sets. Training continues three times weekly, maintaining rest days between sessions.

For athletes with superior overall physical fitness, a thorough understanding of free combat techniques, and the ability to effectively execute training plans, coaches may modify the traditional program by incorporating more dynamic adjustments to limb movements. These modifications involve varying joint angles, acceleration, and rhythm, allowing for greater flexibility and improved training effectiveness. For example, during the first phase of training, traditional planks can be adapted into forearm planks with alternating rear foot lifts, side planks with alternating knee raises, or sawing planks. Similarly, planks performed with hands or feet supported

on an exercise ball introduce additional variability and challenge. In the second phase, ribbed leg lifts can also be diversified. Variations might include shifting the legs to the left or right, performing circular leg movements, or alternating single-leg lifts with the opposite leg stabilized. Coaches can further intensify the training by incorporating weight-bearing exercises, such as having athletes perform seated dumbbell lateral raises while holding a 20 kg dumbbell in one hand. These adaptations integrate static and dynamic movements, enhancing the overall training effect and aligning the exercises with the athlete's specific needs and abilities. This approach ensures a well-rounded development of strength, stability, and explosive power^[9].

4.3. Statistical analysis of stage training data

After completing the core strength training phase, coaches should utilize software such as MATLAB to organize and analyze the athletes' training data. This will help describe the variability in the data, compare the training results, and identify the factors contributing to the differences in outcomes among athletes.

First, the coach can conduct a horizontal comparison of the training results across the group. This involves comparing the peak moments and relative peak moments of the abdominal and back muscle groups for different athletes. Then, a vertical comparison can be made for the same athlete, by analyzing their results before and after completing the core strength phase. This includes comparing the peak moments of the abdominal muscles, hip extensor muscles, and the activation of muscles such as the rectus abdominis, external obliques, erector spinae, gluteus maximus, and latissimus dorsi. These comparisons help provide a more systematic and comprehensive understanding of the positive and negative effects of the training on the athlete's core muscle groups^[10]. Finally, the coaching team should have athletes perform tests measuring the striking force of the straight fist and whip leg to assess the impact of core strength training on the athlete's actual combat performance. This will allow the coach to objectively evaluate the effectiveness of the training and provide insights for further adjustments to the training program.

5. Conclusion

In summary, core strength plays an important role in the competition and training of free combat athletes, so it is necessary for college free combat coaches to plan core strength training programs in a targeted manner and implement the training program scientifically and effectively. Through targeted shoulder joint and back muscle group training, continuous squatting, single-legged support, and other exercise programs, the core strength of the athletes can be strengthened, enhancing body force generation and control as well as body stability.

Disclosure statement

The authors declare no conflict of interest.

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