Research on badminton players' specialized fitness training

Liu Jiamin[1, a, *], He Qiu[1, b],

[1]Hebei Provincial Key Laboratory of Human Movement Biomechanics and Information Assessment, No.20 Naner Huan East Road, Shijiazhuang, Hebei Province,050024, China.
a.jiamin_414241_@yahoo.com, b.heqiu_85_4571@gmail.com
***Corresponding Author**

Abstract: The relationship between specialized physical fitness and skills has always been a controversial issue in China's badminton community. The components of badminton's specialized physical fitness include specialized speed, strength, endurance, and agility. The relationship between the four basic qualities of strength, speed, endurance, and agility is summarized as follows: speed is the key, strength and agility are the foundation, and endurance is the guarantee.

Keywords: Badminton, Specialized Physical Training, Athletes

1. Introduction

Badminton is a complex, comprehensive sport with strong entertainment value, widely loved by the general public. Due to the characteristics of badminton, such as its fast pace, flexibility, intense competition, and ever-changing nature, good physical fitness is essential for withstanding fierce competitions and high-intensity training. In particular, specialized physical fitness plays a crucial role in mastering badminton techniques and performing badminton skills. However, currently, there is a relative lack of research on badminton that combines training methods and means. This gap poses challenges for grassroots coaches and teachers in conducting specialized physical training for badminton. This paper focuses on elaborating the characteristics of badminton's specialized physical fitness, the impact of these specialized physical qualities on sports performance, and the training methods for specialized physical fitness. It aims to provide a reference for badminton coaches and teachers in their training practices.

2. Specialized Fitness &Athletic Performance Relationship

Physical training is an essential component of athletes' competitive ability training. It involves enhancing athletes' physical capabilities by combining specific sport requirements with appropriately loaded exercises to improve body shape, increase physical skills, develop athletic qualities, and purposefully alter body structure and function, thereby promoting the improvement of competitive levels. As competitive standards continue to rise and the intensity of competitions increases, the role of physical training becomes particularly important. Good physical training not only helps athletes master advanced technical movements and improve their performance but also plays a role in preventing injuries and extending their athletic careers.

Specialized physical training refers to the practice of movements specific to a sport and those similar to the technical characteristics of the sport during the training process, as well as improving the energy supply capabilities of various organ systems required for specialized abilities. There is a distinction between specialized and general physical fitness. Specialized physical fitness is determined by the characteristics of the sport, while general physical fitness is trained based on the needs of human movement capabilities. General physical training serves as the foundation, while specialized physical training represents an enhancement. Specialized physical fitness is a necessary but not sufficient condition for improving specialized sports performance. In other words, to enhance specialized sports performance, one must possess good specialized physical fitness. However, having good specialized physical fitness does not

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guarantee excellent specialized sports performance. Conducting some specialized physical training during the foundational stage of an athlete's development allows them to better master the relevant techniques.

In Wang Wei Xing' s paper "The Relationship Between Athletes' Physical Fitness and Technical and Tactical Performance," the traditional notion that "physical fitness is the foundation, and technique is the key" is revised to" technique is the foundation, and physical fitness is the key." This indicates that physical training holds a very important position. Looking at the current development of badminton, specialized physical fitness and skills are equally important.

3. Badminton characteristics &Specialized fitness composition

The characteristics of a sport refer to the unique aspects that distinguish it from other sports. However, to date, the training theory community has not provided a scientific and reasonable explanation for the connotation of sports characteristics. Their explanations are mostly determined from different perspectives based on their own research needs. In the book "Research on Chinese Sports Training Theory and Practice," the characteristics of sports are elaborated from the following four aspects: First, the factors in the rules of the sport that contribute to winning competitions; second, the primary energy supply systems; third, the technical structure of the sport; and fourth, the special physical fitness requirements of the sport. These four aspects are used to determine the characteristics of a sport. Based on these four basic theories, the characteristics of badminton are analyzed as follows:

Firstly, in terms of rules, badminton matches are scored on a 21-point system, and there is no limit on the number of strokes per rally. This determines that the duration of badminton matches is unpredictable and without time limits. Secondly, regarding the energy supply system, badminton requires players to make movements and reach the position to hit the shuttlecock in the shortest possible time. According to the Chinese Sports Coaches'Position Training Tutorial, when discussing the energy metabolism of badminton players, it is pointed out that the energy supply mode of badminton is a combination of aerobic and anaerobic, but mainly based on ATP-CP energy supply. Thirdly, in terms of the technical structure of badminton, the techniques are divided into upper limb and lower limb techniques. The upper limb techniques are versatile and skillful, while the lower limb techniques require strong comprehensive abilities such as stepping, crossing, and jumping. Lastly, the physical fitness requirements for badminton players are that, due to the flexible and ever-changing nature of badminton matches, players need to have good explosive power, endurance, agility, coordination, and flexibility.

Therefore, it can be concluded that the composition of specialized physical fitness in badminton includes four aspects: specialized speed, strength, endurance, and agility. Specialized speed includes technical movement speed (racket swing speed), reaction speed, and movement speed. Specialized strength includes upper limb strength (wrists, forearms, etc.), abdominal muscle strength, and lower limb strength (ankle joints). Endurance mainly includes muscle endurance and cardiopulmonary endurance. Agility includes stopping quickly, starting quickly, and changing directions. In badminton matches, the relationship between the four basic qualities of strength, speed, endurance, and agility is summarized as follows: speed is the key, strength and agility are the foundation, and endurance is the guarantee.

4. Training methods and means for badminton specialized physical fitness

4.1. Specialized speed

Speed is the key to winning in badminton and a manifestation of the sport's capabilities. The current technical and tactical characteristics of badminton in China are summarized as "fast," "accurate," "aggressive," and "flexible." Among these, "fast" refers to the speed of the shuttlecock in the air and the players' movement speed. According to incomplete statistics, Japanese players can achieve a hitting speed of 400 kilometers per hour, while Chinese Olympic doubles champions can reach 380 kilometers per hour. Winning through speed is a crucial factor in badminton, highlighting the importance of speed in the sport. Speed encompasses not only the players' running speed but also their reaction speed, movement speed, and hitting speed, which is the speed of the shuttlecock in flight.

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Therefore, the training methods for developing movement speed and speed endurance can include the following: Sprinting(30m,50m,60m,100m);30-meter shuttle run; Variable speed running in the pattern of(200m-100m-50m-50m) *(6+2);200-meter fast run

Training methods for reaction speed include: Moving in response to signals; Back-to-back signal response games (e.g., "Yangtze River and Yellow River" game); One person tossing the ball and the other catching it with their hands(irregularly); Games like "Fifty Cents and One Dollar"

Training methods for movement speed include: Brachioradialis training; Hanging from a bar with feet off the ground to increase support time; Weighted wrist flexion and extension exercises; Weighted racket swinging practice; Quick foot frequency drills with short steps

Training methods for hitting speed include: Rope skipping training, with a focus on double unders for three minutes.

4.2. Specialized strength

The specialized strength of badminton players can be broadly categorized into upper limb strength, trunk strength, and lower limb strength, based on the characteristics of the movements. These three types of strength together constitute the strength required by badminton players, and it is important to strengthen the connection between them during training. Methods to improve upper limb strength can include the use of auxiliary training equipment, such as small dumbbells, resistance bands, and pull-up bars. Trunk strength training methods can be divided into those with and without equipment, such as Swiss balls, medicine balls, and sit-ups. Lower limb strength training methods can include barbell squats, lunge jumps, and lunges.

The training methods for upper limb strength can include the following: Weighted wrist flexion and extension exercises to develop wrist joint explosive power,100-120 reps per set,2-3 sets, with an interval of 1-3 minutes; Hanging from a pull-up bar to exercise finger strength,60-90 seconds per set,2-3 sets, with an interval of 2-3 minutes; Holding a racket or small dumbbell to control the rotation of the forearm while keeping the elbow and hand joints stationary, targeting the brachioradialis muscle,30-60 reps per set,4-6 sets, with an interval of 2-3 minutes; Bench press, with the weight set at 75%of the individual's maximum strength,8-12 reps per set,4-6 sets.

Trunk strength training mainly includes: Medicine ball toss and catch exercise—one person lies flat on a mat holding a medicine ball overhead and throws it to a person standing in front of their feet, which exercises the waist and abdominal muscles through ball reception,16-24 reps per set, for a total of 6-8 sets, with the weight controlled at 2-3 kg; Double-axis prone Swiss ball exercise can enhance the core strength of athletes,30-60 seconds per set,4-6 sets; Eight-level abdominal bridge,1-2 sets;Sit-ups,30-60 reps per set,4-6 sets, with an interval of 1-2 minutes.

The main exercises for lower limb strength include: Lunge walk without weights for 20-40 meters per set,1-2 sets. Barbell squats with the weight set at 75%of the individual's maximum strength,8-12 reps per set,4-6 sets, and maximum strength training for 2-4 sets. Weighted stationary lunges,12-15 reps per set. Step-up exercises,4-6 sets.

4.3. Specialized endurance

With the continuous improvement of technical skills, the increase in the number of strokes, and the extension of match duration, athletes need the physical capacity to endure intense activities lasting 60 to 90 minutes. This requires good aerobic metabolism and muscle endurance, both of which are crucial for winning in competitions. During regular training, athletes' muscle endurance can be enhanced, and the following methods can be used to improve specialized endurance: To enhance anaerobic metabolism, maximum intensity training can be conducted with work periods lasting between 5 and 15 seconds. To improve lactate metabolism, training can be carried out at 85%to 90%of maximum intensity, with work periods lasting between 30 and 60 seconds. To boost aerobic metabolism, repeated training and interval training methods are primarily used. The commonly used training means are as follows: To improve aerobic endurance, medium to long-distance running can be adopted, including 400 meters to 3000 meters, timed running—such as 6-minute runs and 12-minute runs—as well as cross-country and road running. To enhance anaerobic metabolism, short-distance running can be utilized, such as 50-meter to 200-meter

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sprints and full-court footwork drills—30 to 60 seconds per set of rapid full-court movement to four points, with a total of 8 to 16 sets and an inter-set rest period controlled at 2 to 3 minutes.

4.4. Agility

The concept of agility has not yet reached a unified conclusion in China, and opinions vary. This paper adopts the definition of agility quality in sports training theory written by Tian Mai jiu. It refers to the ability of athletes to quickly, accurately, and coordinately change their body's spatial position and movement direction under various suddenly changing conditions to adapt to the changing external environment. However, the agility required in badminton is mainly reflected in its "ever-changing nature." Therefore, the specialized agility in badminton can be summarized as follows: based on the match and the opponent's situation, players can choose a reasonable position at any time, adjust and change their tactics, and quickly switch actions. They can skillfully combine various techniques, use the time difference and the body's suspension and balance ability to complete the mutual conversion of offensive and defensive skills and tactics, and gain the initiative on the court. The specialized agility training in badminton includes four parts: upper limb agility training, lower limb agility training, hip agility training, and comprehensive agility training. The specific training methods are as follows:

The main means of upper limb agility training include: Twirling the racket handle with fingers,2-3 sets; Racket winding figure-eight practice,60-120 seconds per set,2-3 sets.

The main means of lower limb agility training include: Fast-frequency ladder rope running practice,2-4 sets; Fast-frequency stair running training,2-4 sets; Double unders for 3 minutes,2-3 sets.

The means of hip flexibility training include: Hip rotation practice,30-60 reps per set,2-4 sets; With the left foot as the pivot, the right foot performs a stepping and turning exercise forward and backward,16-24 reps per set,2-4 sets; On-the-spot hip-turning jump practice: the hips rotate continuously to the left and right. When turning right, the right leg rotates outward, and the left leg rotates inward. The toes of both feet maintain the same direction to the right while the body faces forward, and the upper body remains balanced with only the lower limbs rotating,30-60 reps per set,2-4 sets.

Comprehensive agility rope skipping training: Various postures are used for rope skipping practice, including: Small front and back crossover steps and large stride crossover rope skipping practice; High-knee rope skipping practice; Rope skipping practice with feet moving forward, backward, left, and right.

5. Conclusion

In the training and competition process of badminton, physical fitness and skills are equally important. The specialized physical fitness of badminton consists of four aspects: specialized speed, strength, endurance, and agility. Specialized speed includes technical movement speed (racket swing speed), reaction speed, and movement speed. Specialized strength includes upper limb strength (wrists, forearms, etc.), core strength (abdominal muscles), and lower limb strength (ankle joints). Endurance mainly includes muscle endurance and cardiopulmonary endurance. Agility includes the ability to stop quickly, start quickly, and change direction. The relationship between these four basic qualities is as follows: speed is the key, strength and agility are the foundation, and endurance is the guarantee.

The training methods and means for badminton's specialized physical fitness are diverse. Badminton is a sport with ever-changing dynamics, requiring athletes to possess capabilities in various aspects. Therefore, in future specialized training, it is essential to select training methods based on the situation. Training should not focus solely on one aspect but should be comprehensive to improve overall performance.

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