

Comparative Analysis of Physical Fitness between Outstanding Male Tennis Players in Jiangxi Province and the National Team

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Abstract

With the promotion of scientific training and physical fitness training, Shandong Province reformed the Shandong Provincial Championships and Provincial Championships in 2015 to promote the development of tennis. Physical fitness testing was added, accounting for 40% of the total competition results, breaking the previous pattern of only relying on competition results as the final ranking. Therefore, coaches and athletes, while constantly exploring the rules of winning events, paid more attention to specialized physical fitness training. In this context, Shandong Province achieved new breakthroughs in tennis physical fitness training. This study takes excellent male tennis players from Shandong Province, China as an example. By selecting some specific physical fitness indicators of the national team's excellent tennis players, the physical fitness status of Shandong Province's excellent male tennis players is compared. In response to the existing problems, corresponding training strategies are proposed to provide coaches with training plans and specialized training based on the characteristics of athletes in different positions; It can assist athletes, especially young athletes, in adapting to their careers and provide assistance in effectively improving their competitive performance, in order to improve the physical fitness level of outstanding male tennis players in Shandong Province faster and better.

Keywords: Jiangxi Province, China, Tennis Players, Physical Fitness.

Introduction

Tennis is a sport that requires comprehensive physical fitness, requiring athletes to have good endurance, explosiveness, sensitivity, and coordination during the competition. The importance of tennis physical fitness is self-evident, as it directly affects the performance and results of athletes in competitions. Below, I will expand on the importance of tennis physical fitness in more detail: Match endurance, Tennis matches may last for several hours, and athletes need sufficient endurance to cope with continuous running, rapid movement, and frequent hitting during the game.(Zou Zhen, 2014). Good endurance means that athletes

can maintain a high level of performance until the end of the competition. Explosive Power and Speed, In tennis matches, quick reflexes and explosive power are crucial. Quickly reaching the position of the ball, hitting it with greater force, and quickly changing direction all require excellent explosive power and speed. These abilities can help players take the initiative and control the pace of the game (Xiaoyu, Zhijie 2021). Flexibility and Coordination, Flexibility and coordination are necessary for completing various complex actions and techniques. Through good physical flexibility and coordination, athletes can better control their bodies, complete various hitting movements, reduce errors, and improve ball accuracy. Psychological endurance and focus, In intense competitions, psychological endurance and focus are the key to winning. Athletes need to remain calm, confident, and focused, unaffected by external factors, and maintain good performance at critical moments. The strength of psychological qualities often determines the outcome of a competition. Injury prevention, Adequate physical training can reduce the risk of injury for athletes during competitions and training. By strengthening muscles, improving flexibility, and enhancing core stability, it is possible to effectively prevent training stoppages and game absences caused by sports injuries. Tactical execution ability, Excellent tennis balls not only reflect physical fitness, but also directly affect tactical execution ability. In the game, athletes need to flexibly adjust their tactics based on the game situation and the characteristics of their opponents, such as choosing when to attack, when to defend, when to change lanes, and when to launch assaults. Good physical fitness can ensure that athletes can quickly and accurately execute various tactics, and flexibly respond to changes in opponents during competitions. Improve self-confidence and willpower, Adequate physical training can not only improve the physical fitness of athletes, but also enhance their confidence and willpower (General Administration of Sport of the People's Republic of China, 2005). By constantly challenging their limits and breaking through their limitations, athletes can build confidence in their abilities and maintain a tenacious will at critical moments, not giving up easily, and striving for victory with all their might. Reduce the impact of fatigue, In intense competitions, fatigue is often one of the important factors affecting athlete performance. Through sufficient physical training, fatigue can be slowed down and athletes can recover faster from fatigue (Liu, Huaping, 2015). In this way, athletes can maintain higher energy levels and better states during the competition, and continue to perform excellently. Improving competitiveness and defeating opponents, In competitive sports, physical fitness is one of the important factors determining victory or defeat. Having excellent physical fitness can put athletes in a more advantageous position in competitions and make them more likely to defeat opponents (He Ruchun 2014). Whether it's in a long tug of war or a decisive game at a critical moment, excellent physical fitness can help athletes achieve victory. Overall, the tennis ball is not only a key factor affecting the individual performance of athletes, but also directly affects the decision of competition results. Through comprehensive and systematic physical training, athletes can improve their overall strength in competitions, enhance their confidence and willpower, and are more likely to defeat opponents and achieve excellent results.

1.1 Endurance: Tennis matches usually last for several hours, so athletes need to have good endurance to cope with long matches. Continuous running, rapid lateral movement, and frequent arm swinging pose challenges to endurance.

1.2 Sensitivity: In tennis matches, it is necessary to quickly react, make accurate judgments about the speed and direction of the ball, and quickly adjust one's body position. Sensitivity is crucial for catching an opponent's mistake or quickly responding to their attack.

1.3 Explosive Power[1]: In tennis matches, instant explosive power is very important, especially when serving, running to the position of the ball, and completing hitting movements. This explosive power can help players reach the position of the ball faster and hit it with greater force.

1.4 Psychological Endurance: In addition to physical endurance, tennis players also need to have psychological endurance to remain calm, focused, and confident in intense matches, and to cope with various challenges and pressures.

1.5 Coordination: Tennis requires good hand eye coordination, the ability to accurately control the racket to hit the ball and send it to the desired position. In addition, whole-body coordination is also important, especially when moving quickly, changing direction, and completing various hitting movements.

1.6 Flexibility: A flexible body can help players better complete various movements and reduce the risk of injury. Flexibility training helps to increase the range of motion of the body and improve the efficiency and fluency of movements.

With the continuous promotion of scientific training and physical fitness training concepts, Jiangxi Province implemented a series of important reform measures for the Jiangxi Provincial Championships and Provincial Championships in 2015, aimed at promoting the comprehensive development of tennis. A key aspect of the reform is to incorporate physical fitness testing into the competition scoring system and give it a 40% weight on the total score. This adjustment marks the deepening of the evaluation of the comprehensive quality of tennis players, thus breaking through the single mode of ranking only relying on competition results in the past. The introduction of physical fitness testing not only enhances the fairness of the competition, but also encourages coaches and athletes to pay more attention to the systematic and scientific nature of physical training. Against the backdrop of this reform, significant progress has been made in tennis physical training in Jiangxi Province. In the past, physical training may have been just a part of basic training, but now it has become a core component of tennis training. Athletes must pay attention to specialized physical training during the preparation process, including strength, speed, agility, flexibility, and endurance. This change is not only crucial for improving athletes' competitive level, but also has a profound impact on their long-term career development. This study selected outstanding male tennis players from Jiangxi Province, China as research subjects, and systematically evaluated the physical fitness status of athletes in Jiangxi Province by comparing and analyzing some key physical fitness indicators of national team outstanding tennis players (National Physical Fitness Monitoring Centre, 2022). This comparison not only reveals the specific advantages and disadvantages of athletes in physical fitness in Jiangxi Province, but also provides data support for proposing improvement measures. For example, by comparing data, it was found that there is a significant gap in agility and explosiveness among athletes in Jiangxi Province. These physical differences not only affect athletes' performance in

competitions, but may also limit their ability to perform at critical moments. This study proposes specific training strategies for the identified physical fitness issues. These strategies include but are not limited to the following aspects: specialized physical training: developing personalized training plans based on athletes' technical characteristics and competition needs. For players who require quick reflexes and flexible movements, agility training and fast footwork exercises can be added; For players who require strong explosive power, emphasis can be placed on strength training and explosive power training. Comprehensive physical training: A comprehensive training program that combines physical fitness and technical training. For example, by incorporating physical training elements into actual combat simulations, athletes can enhance their physical adaptability in high-intensity competitions. Physical recovery training: Develop a scientific recovery plan, including stretching, massage, nutritional supplementation, etc., to help athletes quickly recover and maintain their best competitive state after high-intensity training and competition (National Centre for Physical Fitness Monitoring (NCFM) 2022.6). Technical and physical training: By combining technical movements with physical training, athletes can improve their overall performance in competitions. For example, incorporating strength and agility training when practicing serving and receiving can improve the efficiency and stability of technical movements. Especially for young athletes, these physical training programs not only help them adapt to the high-intensity demands of their careers, but also effectively improve their competitive performance. A systematic physical training program can help young athletes quickly improve their physical fitness, overcome physical bottlenecks, and lay a solid foundation for their future career development. Through a detailed analysis of the physical fitness status of outstanding male tennis players in Jiangxi Province and the proposal of improvement measures, this study provides scientific training guidance for coaches and practical basis for athletes' physical fitness improvement (Chen Jun, 2020).. These measures and strategies can not only help athletes perform better in competitions, but also promote the overall progress and development of tennis in Jiangxi Province. The reform of physical fitness testing for championships and provincial championships in Jiangxi Province has promoted the deep integration of physical training, prompting coaches and athletes to pay more attention to the improvement of physical fitness. Through systematic physical training and scientific training strategies, the physical fitness level of outstanding male tennis players in Jiangxi Province has been significantly improved, laying a solid foundation for their success in high-level competitions. At the same time, this reform has injected new vitality and momentum into the development of tennis as a whole, promoting the long-term development of tennis in Jiangxi Province.

Problem Statement

Problem statement

This study focuses on outstanding male tennis players from Shandong Province, China, aiming to explore the differences in their physical fitness status compared to top national tennis players through comparative analysis. Firstly, the study selected key physical fitness indicators of some outstanding tennis players from the national team, such as strength, endurance, speed, flexibility, and reaction time, to establish a standardized physical fitness benchmark. These indicators provide a scientific basis for evaluating the physical fitness status of athletes in Shandong Province. Through systematic data collection and comparative analysis, the

research team explored in detail the performance of athletes in Shandong Province on the above physical fitness indicators, and compared them with the level of national team athletes. During this process, we identified some key issues, such as insufficient strength, lack of endurance, and weaknesses in flexibility and reaction time. These issues directly affect the performance and training effectiveness of athletes in competitions. To address these issues, research has proposed targeted training strategies. These strategies include but are not limited to enhancing strength training, improving endurance training methods, and specialized training to improve flexibility and reaction speed. In addition, the study developed more precise training plans based on the characteristics of athletes in different positions, such as the different needs of forward interception type and backcourt baseline type athletes. These plans not only consider the physical condition of athletes, but also combine technical and tactical requirements to better enhance their overall performance. In terms of specific implementation, we have provided coaches with detailed training plans and specialized training recommendations (Cheng Lifan, 2016). These plans cover adjustments to daily training, methods for improving specific physical fitness indicators, scientific arrangements for training intensity, and management of recovery periods. We hope to help athletes, especially young athletes, adapt to various needs in their careers and comprehensively improve their competitive performance through these systematic measures. Overall, this study aims to promote the improvement of physical fitness and competitive performance of outstanding male tennis players in Shandong Province through scientific physical fitness assessment and targeted training strategies, in order to achieve higher competitive levels and faster growth and progress (Anwei, 2014)

Research Objective

This study aims to investigate the development of tennis in Jiangxi Province by exploring its construction, analyzing its current situation, comparing and examining its development strategies. RO1.2 focuses on understanding the basic framework of tennis in Jiangxi Province. RO3.4 needs to check the current situation of tennis in Jiangxi Province. Finally, RO3 aims to analyze the specific strategies of tennis in Jiangxi Province. Through these research objectives, we will gain a comprehensive understanding of the development of fitness qigong in Jiangxi Province.

Research Question

RQ1: Improving physical fitness: includes training in endurance, explosiveness, speed, flexibility, and coordination to enhance the physical fitness of athletes and enable them to maintain a high level of performance during competitions.

RQ2: Technical skills improvement: includes training in technical aspects such as serving, receiving, baseline hitting, volleying, tactical layout, etc., to improve the accuracy, strength, and technical diversity of athletes in hitting, and enhance their ability to cope with different game situations.

RQ3: Cultivation of tactical awareness: Cultivate the sensitivity and judgment ability of athletes to the competition situation, so that they can flexibly adjust their tactics according to the characteristics and competition situation of their opponents, identify their weaknesses and make use of them.

RQ4:Improvement of Psychological Quality:This includes training in areas such as self-confidence, focus, willpower, and the ability to cope with stress, in order to enhance the psychological quality of athletes in competitions, enabling them to remain calm, confident, and perform at their best level at critical moments.

RQ5:Injury prevention and rehabilitation:includes preventive strength training, flexibility training, and proper exercise posture training to reduce the risk of injury for athletes during competition and training, and accelerate the recovery process after injury.

Significant of the Study

The Importance of Research

Theoretical significance: It fills the gap in the research field of tennis development in Jiangxi Province and provides theoretical reference for the government to formulate corresponding policies.

Practical significance: To sort out the current situation and direction of tennis development in Jiangxi Province, point out advantages, disadvantages, opportunities, and threats, and propose specific implementation plans for development strategies.

Literature Review

Research on the Development of Tennis

Tennis is a sport that requires extremely high physical fitness. Athletes not only need to have excellent endurance to cope with long-term competitions and multi set confrontations, but also need to have strong explosive power to quickly launch attacks and respond quickly. In addition, agility is also one of the key qualities for tennis players, as they must quickly move, change direction, and adjust posture on the court to respond to opponents' shots. Good coordination enables athletes to better control the accuracy and strength of their shots, ensuring that every swing achieves optimal results (Long,2024)

Research on the Development of Tennis Physical Fitness

The cultivation of tennis physical fitness not only involves basic physical fitness training, but also includes the improvement of specialized skills. Athletes need to undergo systematic strength training, endurance training, and flexibility training, while also improving their reaction speed and technical stability on the field through simulated competitions and technical exercises. The importance of physical fitness in tennis cannot be underestimated, as it directly affects the performance of athletes in matches, determining whether they can maintain their best form in high-intensity confrontations, and thus affecting the final game results (Jing 2024)

Fitness for All and Tennis

National fitness is an effective way to improve the physical and mental health of the elderly and to get rid of the "aging crisis", while ethnic traditional sports, which are unique to the Chinese nation, are obviously more suitable for the elderly to exercise compared with intense Western sports (Jiangping, 2023).National fitness has been upgraded to a national strategy, and physical fitness has become an important strategic deployment to achieve "Healthy China" at this stage (Qian, 2022).Most students were in favour of Health Qigong in colleges and universities, while some were neutral. Most teachers believe that Health Qigong has a

broad development prospect in colleges and universities and hold a firm supportive attitude (Huagen, 2020).

Development Strategy of Tennis

With the gradual increase in the content of gong methods, the gradual expansion of participating groups, and the gradual expansion of the scope of external promotion, this complexity will gradually present a kind of uncertainty and variability in development, (Zhang Xinmiao, 2014). Increase publicity to expand the influence of tennis in colleges and universities; establish tennis clubs and actively carry out after-school activities. (Chen Jun, 2020).

Method

Expert Interview Method

Visit 10 experts in the field of physical fitness training from professional sports colleges such as Beijing Sport University, Shanghai Sport University, Guangzhou Sport University, and Shandong Sport University to understand the specialized physical fitness training of outstanding tennis players in China, and provide professional guidance for this study.

Questionnaire Survey Method

In order to ensure the accuracy of physical fitness diagnosis for outstanding male tennis players in Shandong Province, a survey questionnaire for outstanding male tennis players in Shandong Province was designed. 18 questionnaires were distributed to outstanding male tennis players in Shandong Province, with a recovery rate of 100%.

Observation Method

By tracking 9 outstanding male tennis players in Shandong Province for a period of 2 months, recording and collecting relevant data, observing and understanding the training status of excellent male tennis players in Shandong Province, obtaining first-hand information, and analyzing the data, this provides a basis for the diagnosis and training strategy research of tennis ball.

Data Statistics Method

Using SPSS 26.0, the speed, strength, endurance, coordination sensitivity, and flexibility indicators of excellent male tennis players in Shandong Province were described and statistically analyzed. Corresponding statistical standards were used to quantify the indicators, providing a basis for the diagnosis of specialized physical fitness of excellent male tennis players in Shandong Province.

Findings

In various specialized competitive sports, physical fitness is the basis for athletes to obtain competition rankings, and tennis players are no exception. Good physical fitness can ensure that tennis players can better exert their technical and tactical skills, and is also an important factor for tennis players to win competitions. This study selected some specialized physical fitness indicators (speed, strength, endurance, agility, and flexibility) (Yu Xi. 2014) of outstanding tennis players from the national team to compare the physical fitness status of outstanding male tennis players in Shandong Province, in order to improve their physical fitness level faster and better. The specific indicators are detailed in Table 1:

Table 1 Comparison of Specific Physical Fitness Indicators between Excellent Male Tennis Players in Jiangxi Province and Excellent Tennis Players in China

First level indicator	second level indicator	third level indicator	Shandong Province Excellent Tennis Athlete Ratio	National Team Excellent Tennis Athlete Ratio
Speed quality	Starting speed	5m sprint (S)	<1.12	≤1.01
	Movement speed	10m sprint (S)	≤1.98	≤1.78
		20m sprint (S)	≤3.71	≤3.27
	Action speed	15 second single leg single arm push ups (pieces)	≥10.71	≥15.2
Strength and quality	Special Forces	Forehand closed footwork throwing solid ball (M)	≥10.64	≥11.96
		Backhand closed footwork throwing solid ball (M)	≥8.65	≥10.14
	Fast Power force at the core	Standing Long Jump (M)	≥2.20	≥2.29
		Push ups (pieces)	≥39	≥46
Endurance quality	Aerobic endurance	Beep Test (gr)	≤11.9	≤10.1
	Anaerobic endurance	Double line turnaround run (S)	≤24.2	≤20.3
Sensitivity quality	Generally coordinated and sensitive	Left lane turn forward sprint (S)	≤4.9	≤4.6
		Right lane turn forward sprint (S)	≤4.6	≤4.4
	Special coordination and sensitivity	Left lane turn back sprint (S)	≤2.7	≤2.6
		Right lane turn back sprint (S)	≤2.7	≤2.5
Flexibility	General flexibility	Front wheel drive in seated position (cm)	≥13.44	≥17.24
	Lower limb ability	15 seconds quick kick (pieces)	≥8.1	≥10.4
		15 second suspension leg lift (piece)	≥12.9	≥16.6

Speed Quality is the Core of Physical Training for Tennis Players

As a cross net competition, tennis is different from other similar sports. The design of tennis courts determines the unique challenges that athletes face during matches: the distance from the court baseline to the net is only 12 meters. (Yi, Dejin, 2024) This relatively short distance requires athletes to constantly engage in high-intensity back and forth running during the competition, especially between the baseline and the net. This type of competition requires athletes to possess extremely high specialized speed, including reaction speed, displacement speed, and movement speed. Firstly, the reaction speed of tennis players is crucial. In the game, players need to make quick judgments and reactions to the speed, direction, and rotation of incoming balls in a very short amount of time. This not only requires athletes to have extremely high visual and neural system sensitivity, but also requires them to have excellent psychological qualities to remain calm and make the right decisions. (Yijin, Yiqin2014)

Secondly, displacement speed is also a key ability that tennis players must possess. Due to the design of the field, players need to frequently run back and forth between the baseline and the net, and their ability to move quickly directly affects their performance in the game. The displacement speed not only involves the leg muscle strength and endurance of the player, but also includes the coordination and stability of the athlete during high-speed movement. Effective displacement can help players better receive and hit the ball, and quickly adjust their stance to adapt to their opponents' various hitting strategies. Finally, speed of movement is equally important in tennis matches. This includes the speed and accuracy of the hitting action. In the fast-paced game, athletes need to complete complex technical movements in a very short amount of time, such as swinging, hitting, changing the angle of the ball, etc. The speed of movements not only needs to be improved through strength training and technical exercises, but also requires athletes to maintain good coherence and stability in their

movements during competitions. Overall, the specialized speed of tennis players is a comprehensive reflection of multiple abilities. When facing the constantly changing competition environment, they not only need to have a strong foundation of strength, but also need to undergo comprehensive training and improvement in reaction speed, displacement speed, and movement speed. This comprehensive demand for sports makes tennis an extremely challenging sport, requiring athletes to achieve comprehensive development in strength, speed, and technique (Dan Zhenhua 2024). From Table 1, it can be seen that: (1) The starting speed of outstanding male tennis players in Shandong Province is less than 1.12S, which is 0.11S lower than that of outstanding tennis players in the national team. This means that outstanding male tennis players in Shandong Province have slower reaction speed than those in the national team. At the same time, through monitoring equipment such as force measuring tables and laser measurements, it was found that the reaction speed of outstanding male tennis players in Shandong Province is much lower than that of outstanding tennis players in the national team. And reaction speed refers to an athlete's ability and level of reaction to the landing point of a tennis ball. Improving reaction speed can effectively enhance an athlete's judgment and handling of the ball, thereby improving their technical level. (2) The movement speed of outstanding male tennis players in Shandong Province is less than 1.98S, which is 0.2S different from the displacement speed of outstanding tennis players in the national team. This means that outstanding male tennis players in Shandong Province do not have a high movement speed when facing a ball horizontally or vertically. In a game lasting more than 2 hours, athletes will have 200-400 short distance fast runs, which requires athletes to further improve their displacement speed in attack and defense. (3) Observing high-level matches of the national team, it was found that outstanding tennis players in the national team are usually at the best hitting point before the ball lands, with a very fast hitting speed and an average of 4 lane changes per point scored. Especially in the test of movement speed, tennis players from Shandong Province are significantly weaker than those from the national team, and the gap is particularly evident.

5.3 Strength quality is the foundation of physical training for tennis players

In high-level tennis matches, athletes' performance is not only determined by their technical level and tactical arrangements, but also deeply influenced by their physical fitness. Especially in high-intensity game rhythms, such as 10 round trips taking only 15 seconds, tennis players are required to possess extremely high levels of specialized strength, rapid strength, and core strength. Among them, explosive power is particularly important for tennis players, as it directly affects the power and speed of hitting the ball, as well as the athlete's ability to move quickly on the court. Specialized strength is a key factor for tennis players to perform well in competitions. Specialized strength refers to the strength required by athletes to perform specific sports skills, including the strength of the upper limbs, waist and abdomen when hitting the ball, as well as the explosive power of the legs. From Table 1, it can be seen that there is not much difference between outstanding male tennis players in Shandong Province and those in the national team in terms of core strength and fast strength, but there are significant deficiencies in specialized strength. For example, in the closed footwork throwing solid ball test in forehand and backhand positions, Shandong athletes lagged behind national team athletes by 1.32 meters and 1.49 meters, respectively. This gap directly affects the performance of athletes in the competition, especially in terms of the strength and speed of each beat, where the quality has not reached its optimal state. The direct consequence of insufficient specialized strength is reflected in the athletes' hitting movements. The explosive

power of the upper limbs and waist and abdomen is not strong, resulting in insufficient strength when hitting the ball, which in turn affects the speed and quality of the hit. When adjusting position, the explosive power of the legs is weak, which also makes it difficult for athletes to quickly generate enough starting force and speed during movement, thus unable to apply enough pressure to the opponent and losing the initiative in the competition. Overall, the lack of specialized strength makes it difficult for athletes to perform at their best in high-intensity competitions. In contrast, excellent tennis players in the national team focus on improving the stiffness of lower limb muscles and tendons during training. This not only effectively reduces the risk of sports injuries, but also greatly improves their strength and fitness. The strength and stiffness of lower limb muscles are crucial for an athlete's overall explosive power, as they can support rapid movement on the field and generate strong hitting power. Through this system of strength training, national team athletes can demonstrate higher explosive power and faster reaction speed in competitions, ensuring a favorable position in intense competition. High level tennis competitions require athletes to possess excellent specialized strength, rapid strength, and core strength, with explosive power being particularly crucial. In response to the lack of specialized strength, athletes need to undergo targeted strength training to improve their hitting power, speed, and mobility, so as to better utilize their advantages in the competition. The successful experience of national team athletes shows that systematic strength training can significantly improve their competitive level and is a key factor in winning high-level competitions.

Endurance Quality is the Guarantee of Physical Training for Tennis Players

Tennis is a high-intensity, highly competitive, and long-lasting sport. The endurance quality of athletes plays a crucial role in competitions, directly affecting the outcome of the competition. In a tennis singles match, athletes typically need to perform around 300 rapid runs, accompanied by a large number of left and right runs, sudden stops, and sudden jumps. This sustained high-intensity activity makes the endurance quality of athletes particularly important, especially in the later stages of the competition. If an athlete's endurance is not sufficient, it may lead to a decrease in hitting quality and slower running speed, thereby affecting the overall competitive level. The endurance quality of tennis players is closely related to their energy metabolism ability. The energy supply of tennis mainly relies on the phosphate system and glycolysis system, which together support athletes' high-intensity performance in the game. Although the energy metabolism of tennis players is a mixture of aerobic and anaerobic, the contribution of anaerobic metabolism is more significant. This means that athletes need to rely on a strong and fast recovering anaerobic metabolic system to maintain a high level of competitive performance during competitions. From the data, it can be seen that there is no significant difference in aerobic endurance between outstanding male tennis players from Shandong Province and those from the national team. However, in terms of anaerobic endurance indicators, the performance of Shandong athletes lags significantly behind, with a gap of up to 3.9 highlighting the obvious differences between the two. This data reflects the gap in physical training between athletes from Shandong Province and national team athletes. National team athletes improve their anaerobic endurance and energy recovery ability through systematic resistance training, which enables them to maintain excellent performance in the later stages of the competition, demonstrating faster movement speed, more accurate hitting, and more stable competitive state. The training of national team athletes not only focuses on improving strength and endurance, but also places special emphasis on resistance training to enhance anaerobic endurance and improve energy

recovery efficiency. This training method can effectively improve the endurance quality of athletes, enabling them to maintain a high level of competitiveness in long-term high-intensity competitions. Therefore, in the later stages of the competition, national team athletes are usually able to adapt to the pace of the game better than their opponents and maintain a higher level of performance. Tennis matches pose a severe challenge to the endurance of athletes. Athletes must possess excellent aerobic and anaerobic endurance to cope with high-intensity competition demands. Systematic physical training, especially the improvement of anaerobic endurance, is a key factor determining whether athletes can maintain their advantage in the later stages of the competition. National team athletes can demonstrate stronger physical advantages through scientific training methods in long-term competitions, which lays a solid foundation for their success in high-level competitions.

Sensitivity and Flexibility are the Key to Successful Sports Training for Tennis Players

Sensitivity and flexibility are two essential components of tennis physical training, which have a crucial impact on the performance and success of tennis players. Sensitivity refers to the ability of athletes to quickly react and adjust during competitions. It reflects athletes' ability to cope with sudden changes and their efficiency in completing movements in a very short period of time. In tennis matches, agility is particularly important because the pace of the game is extremely fast, and athletes often need to react quickly and adopt corresponding tactics when facing unexpected hits or changes in the ball from their opponents. This ability not only helps athletes adjust their position and movements in defense in a timely manner, but also enables them to quickly counterattack during offense, thereby increasing their chances of scoring. Therefore, agility is a key factor for tennis players to stand out in intense matches. From the data in Table 1, it can be seen that in terms of specialized coordination sensitivity, the gap between outstanding male tennis players in Shandong Province and those in the national team is 0.4 seconds. This gap indicates that athletes from Shandong Province are significantly lagging behind national team athletes in terms of rapid coordination ability. National team athletes, with their high-level agility, are able to respond more quickly to unexpected situations in the game, adjust tactics flexibly, and thus perform better in the application of skills and tactics. This sensitivity enables them to more effectively utilize their skills and tactics in the game, increasing the likelihood of victory. Flexibility is equally crucial for the performance of tennis players. Flexibility not only has a significant impact on the quality of athletes' technical movements, but also effectively reduces the risk of injury. In tennis matches, high difficulty technical movements such as serving, high-pressure balls, and various spinning balls require good flexibility to complete. Excellent flexibility can help athletes adjust their body posture more freely, thereby better performing technical movements and reducing the risk of injury caused by body stiffness. From the data in Table 1, it can be seen that there is not much difference in flexibility between outstanding male tennis players in Shandong Province and those in the national team. This means that athletes from Shandong Province are at a similar level of flexibility as national team athletes, and their flexibility has not had a significant impact on their technical movements and athletic performance. However, continuous flexibility training is still a key factor in improving athletes' performance, especially when performing difficult movements. Flexibility can bring higher technical quality and lower risk of injury. In summary, agility and flexibility play important roles in tennis physical training. Sensitivity determines the reaction speed and coordination ability of athletes in competitions, and is the key to responding to rapidly changing competition environments; Flexibility affects the quality of athletes' technical movements

and the risk of injury. Training for these qualities can help athletes perform at their best in competitions and enhance their overall athletic abilities. National team athletes have demonstrated significant advantages in these two areas through high-level training and practice, laying a solid foundation for their success.

Discussion

Schedule for Speed and Quality Training

In terms of speed training, tennis players in Shandong Province can mainly use general speed training to develop basic speed, and combine it with a large number of specialized speed training to complete running in various directions. Train and develop basic speed at a moderate pace during the general preparation stage; During the specialized preparation stage, athletes are trained using methods such as 5M, 20M back and forth running training, and small step training to improve their basic speed and specialized speed; In the pre match and competition stages, the main training methods used include resistance swing training for each pair of nets, cross step training, multi ball training for small balls and baseline balls, etc., vigorously developing athletes' specialized speed, while increasing the combination of speed training and specialized skills, so that athletes can demonstrate excellent speed quality during the competition.

Arrangement of Strength and Quality Training

In terms of strength training, it is recommended that tennis players in Shandong Province focus on trunk stability strength and lower limb strength training, while considering the impact on speed. Conduct small strength training during the general preparation phase; In the special preparation stage, gradually increase the proportion of trunk stability strength and lower limb strength training, and while conducting strength training, gradually develop the use of trunk stability strength and lower limb strength when receiving balls in the game; When entering the pre competition and competition stages, the focus is on training athletes' lower limb explosive power and functional strength. Overall, the proportion and intensity of strength training during the specialized preparation stage, pre competition stage, and competition stage are relatively high, resulting in a significant improvement in athletes' muscle strength during the competition.

Endurance Training Schedule

Tennis players mainly rely on the phosphate system and glycolysis system for energy supply, with the phosphate system and glycolysis system accounting for 70% and 20% respectively, while the aerobic metabolism system only accounts for 10%. In terms of endurance training, excellent male tennis players in Shandong Province should focus on general endurance training and specialized endurance training. In the general preparation stage, a combination of anaerobic endurance training and aerobic endurance training is mainly used to enhance athletes' exercise endurance in high-intensity and long-term competitions; During the specialized preparation stage, increase the proportion of specialized endurance training and anaerobic endurance training. While conducting specialized endurance training, gradually develop the ability to effectively utilize the body's endurance in competitions, as well as cultivate the psychological and willpower qualities of athletes in a state of fatigue; When entering the pre competition and competition stages, the focus is on athlete specific endurance training, enabling athletes to effectively utilize their body endurance during the competition.

Training Arrangement for Agility and Flexibility

Excellent male tennis players in Shandong Province can mainly use rope ladder training to enhance their agility and coordination in running in various directions on the court by changing their movements in different ways. In the general preparation stage, the main training steps are: In the special preparation stage, increase the coordination of the upper limbs, shoulders, waist, abdomen, and lower limbs when swinging the arm to hit the ball; Entering the pre competition stage, training is carried out using techniques such as cross step and small break steps to reduce workload and assist with psychological regulation. Flexibility training is aimed at enhancing the flexibility of athletes in terms of the range of motion of their hip, knee, waist, and wrist joints, as well as the stretching ability of their upper and lower limb muscles and ligaments. It mainly focuses on strengthening and improving athletes' flexibility during general and specialized preparation stages; Entering the pre competition stage, the load needs to be reduced to avoid sports injuries.

Further Studies

In order to address the shortcomings of this study, future development directions have been proposed: firstly, to expand the sample size with the goal of expanding and prospecting, and to conduct surveys, accurate sample research, and analysis on tennis projects. Conduct more in-depth research on the research subjects nationwide and strive to ensure the investigative nature of the collected data to make the research results more realistic. Secondly, strengthen the positive and healthy tennis effect.

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