MEASUREMENT INDEX SYSTEM OF SPECIFIC PHYSICAL TRAINING FOR TENNIS ATHLETES

SISTEMA DE ÍNDICE DE MEDIÇÃO DO TREINAMENTO FÍSICO ESPECÍFICO PARA ATLETAS DE TÊNIS

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SISTEMA DE ÍNDICE DE MEDICIÓN DEL ENTRENAMIENTO FÍSICO ESPECÍFICO PARA DEPORTISTAS DE TENIS

ABSTRACT

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Introduction: Tennis is a competitive sport endowed with subtle movements, sophisticated and changeable techniques and tactics, and intense confrontation. It has high demands on the athlete's physical and psychological qualities. To win high-level professional tennis events, in addition to basic skills, comprehensive technical and tactical abilities, stable psychological quality, and flexible and innovative thinking, tennis players must also have exceptional physical fitness. Objective: Study the index system for evaluating the sport-specific skills of tennis athletes. Methods: 30 youth tennis training athletes were selected. Research methods such as literature, expert interview, questionnaire, and mathematical statistics were used to construct the fitness evaluation index of Chinese professional tennis players. Results: Professional tennis players' specific fitness assessment indexes include one first-level index, 14 second-level indexes, and 23 three-item indexes. Conclusion: Young athletes must strengthen their agile attack speed, explosive strength, core strength, and coordination. The individual indicators are weighted according to individual standards of physical training level. Thus, the five first-level indicators and specific fitness standards are established in this paper. The results of this research have guiding significance for the formulation and implementation of further tennis education and training plans. *Level of evidence ll; Therapeutic studies - investigation of treatment outcomes.*

Keywords: Tennis; Physical Education and Training; Validation Study.

RESUMO

Introdução: O tênis é um esporte de competitividade dotado de movimentos sutis, técnicas e táticas sofisticadas e passíveis de mudança, e intenso confronto. Possui altas exigências quanto às qualidades físicas e psicológicas do atleta. Para vencerem eventos de tênis profissionais de alto nível, além de habilidades básicas, habilidades técnicas e táticas abrangentes, qualidade psicológica estável e pensamento flexível e inovador, os tenistas também devem ter uma aptidão física excepcional. Objetivo: Estudar o sistema de índice de avaliação das habilidades esportivas específicas dos atletas de tênis. Métodos: Selecionou-se 30 atletas de treinamento juvenil de tênis. Métodos de pesquisa como a literatura, entrevista com especialistas, questionário e estatísticas matemáticas foram utilizados para construir o índice de avaliação da aptidão física particular dos jogadores profissionais de tênis chineses. Resultados: Os índices específicos de avaliação da aptidão física dos tenistas profissionais incluem um índice de primeiro nível, 14 índices de segundo nível e 23 índices de três itens. Conclusão: É preciso que os jovens atletas fortaleçam sua velocidade de ataque ágil, força explosiva, força central e coordenação. Os indicadores individuais são ponderados de acordo com os padrões individuais de nível de treinamento físico. Desta forma, os cinco indicadores de primeiro nível e os padrões específicos de aptidão física são estabelecidos neste documento. Os resultados dessa pesquisa têm significado orientador para a formulação e implementação de planos de ensino e treinamento de tênis posteriores. Nível de evidência II; Estudos terapêuticos - investigação dos resultados do tratamento.

Descritores: Tênis; Educação Física e Treinamento; Estudo de Validação.

RESUMEN

Introducción: El tenis es un deporte de competitividad dotado de movimientos sutiles, técnicas y tácticas sofisticadas y cambiantes, y un enfrentamiento intenso. Posee altas exigencias en cuanto a las cualidades físicas y psicológicas del atleta. Para ganar eventos de tenis profesional de alto nivel, además de las habilidades básicas, de las habilidades técnicas y tácticas completas, de la calidad psicológica estable y del pensamiento flexible e innovador, los tenistas también deben tener una forma física excepcional. Objetivo: Estudiar el sistema de índices para evaluar las habilidades deportivas específicas de los atletas de tenis. Métodos: Se seleccionaron 30 atletas juveniles de entrenamiento de tenis. Se utilizaron métodos de investigación como la literatura, la entrevista a expertos, el cuestionario y la estadística matemática para construir el índice de evaluación de la aptitud física de los tenistas profesionales chinos. Resultados: Los índices específicos de esgundo nivel y 23 índices de tres elementos. Conclusión: Es necesario que los jóvenes atletas refuercen su velocidad de ataque ágil, su fuerza explosiva, su fuerza central y su coordinación. Los indicadores individuales se ponderan en función de las normas individuales de nivel de entrenamiento físico. De este modo, en este documento se



establecen los cinco indicadores de primer nivel y las normas específicas de aptitud. Los resultados de esta investigación tienen una importancia orientadora para la formulación y la aplicación de nuevos planes de educación y formación en materia de tenis. Nivel de evidencia II; Estudios terapéuticos - investigación de los resultados del tratamiento.

Descriptores: Tenis; Educación y Entrenamiento Físico; Estudio de Validación.

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INTRODUCTION

In addition to basic skills, comprehensive tactics, stable psychological guality, and flexible, innovative thinking, athletes must have the exceptional physical fitness to succeed in professional tennis events. Athletes' specific physical fitness is conducive to developing and improving professional skills.¹ An excellent contemporary tennis player must be able to explode instantaneously, move quickly, balance, confront strength, and adjust posture. In high-intensity competitions, the particular physical qualities of athletes, such as strength, speed, agility, endurance, and flexibility, are very critical. Even in modern tennis, specific physical fitness is an important indicator that affects its technical level. Currently, the research on Chinese tennis players mainly focuses on the construction of athletes' physical fitness diagnostic indicators, the research on training characteristics, the research training experiments, and the research on physical fitness training indicators. This article refers to a large number of literature and systematically studies outstanding athletes' professional physical fitness. This paper aims to establish an index system of special physical training for Chinese elite players by investigating the physical fitness of tennis players. The research results of this paper aim to improve the efficiency of special physical training for Chinese elite tennis players.

METHOD

Research objects

This article selects 30 tennis training camp players. There were no significant differences among athletes regarding height, weight, years of training, and specific physical fitness.

Investigation method

Expert interview

This paper has conducted in-depth discussions with 20 experts, including national tennis experts and scholars and relevant leaders of the youth group of the Tennis Center.² These professionals have provided some new ideas and materials for the research work of this paper.

Observational data

This paper makes statistics on the relevant data of the national youth tennis training camp players. This article investigates the overall situation of the athletes' exceptional physical fitness.³ These data provide the basis for developing methods of exercise training.

Questionnaire survey

The article uses the basic principles of the questionnaire survey method to compile the corresponding "professional survey table." The selected indices are validated in this paper. We conducted a questionnaire survey in the junior tennis training camp.⁴ The recovery rate was 100%.

Methods for evaluating the exceptional physical fitness of tennis players

This paper uses the power function or approximation weight method to obtain its maximum eigenvalue and corresponding canonical eigenvector. Below is the detailed procedure.

1. This article operates on the product of the cells of the matrix of each column

$$g_k = \prod_{k=1}^n \alpha_{kh} \quad k = 1, 2, \cdots, n \tag{1}$$

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2. The operation of n times the root number

$$\overline{\gamma}_k = \sqrt[n]{g_k} \tag{2}$$

3. The normalized vector $\overline{p} = (\overline{p}_1, \overline{p}_2, \dots, \overline{p}_n)^T$ is expressed as follows

$$\hat{\gamma}_{k} = \frac{\overline{\gamma}_{k}}{\sum_{h=1}^{n} \overline{\gamma}_{h}} \quad h = 1, 2, \cdots, n \tag{3}$$

At this point, we obtain $\hat{\gamma} = (\gamma_1, \gamma_2, \dots, \gamma_n)^T$ as an approximation of the desired eigenvector. An approximation of this coefficient is the weighting of each factor.

4. Obtaining the largest eigenvalue

$$\theta_{\max} = \frac{1}{n} \sum_{k=1}^{n} \frac{(C\hat{\gamma})_k}{\gamma_k}$$
(4)

Here $(C\hat{\gamma})_k$ is the *k* element of the vector $C\hat{\gamma}$. The following index weight calculation is performed after the correlation weighting of the first index. A hierarchical structure consisting of T target layers, C indices, and B indices is designed, where the weight of the relationship between the target layer T and the first index C is $\bar{\gamma} = (\gamma_1, \gamma_2, \cdots, \gamma_n)^T$, $k = 1, 2, 3, \cdots, k$).

The relative weights of each index α_k ($i = 1, 2, 3, \dots, k$) of the first index C and the *n* indices of the second index B are: $\overline{\gamma} = (\gamma_1, \gamma_2, \dots, \gamma_n)^T$, $k = 1, 2, 3, \dots, k$) T. According to the above method, the weight of the particular physical fitness index of tennis players is finally determined.

Data Analysis

This paper uses Excel 2012 to investigate and test the obtained data. This paper uses statistical software such as Excel2012 and SPSS18.0 to organize the collected data. This paper aims to formulate particular physical fitness evaluation indicators for Chinese tennis players.

Ethical Compliance

Research experiments conducted in this article with animals or humans were approved by the Ethical Committee and responsible authorities of Hebei Sport University following all guidelines, regulations, legal, and ethical standards as required for humans or animals.

RESULTS

Construction of the general numerical model

The general value model of Chinese tennis players' special physical fitness evaluation is a quantitative model that reflects their unique physical

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fitness characteristics. This is the basis of physical fitness choices for tennis players.⁵ At the same time, this is also a comprehensive summary of the specific physical fitness of tennis players. (Table 1)

The formulation of specific physical fitness evaluation criteria for athletes

This paper uses the percentile method to analyze the various unique physical fitness scores and evaluation standards of domestic tennis players.⁶ This paper uses different scoring standards to calculate the total quality and theoretical scores of players of different levels. According to the statistics of the data, the professional ability scores and evaluation indicators of Chinese professional tennis players were determined. (Table 2)

The great physical fitness test is a dimensionless detection of the individual test indices of various units of measurement. This can reflect the overall quality of the athlete. First, this paper grades each indicator of the previous item according to the individual performance and the weighting of each indicator. In this way, the overall score of each item is determined.⁷ In this paper, the evaluation indexes of exceptional physical fitness of Chinese tennis players are obtained according to the scores of various exceptional physical fitness of athletes. This paper adopts the comprehensive evaluation method established by the percentile

method. Secondly, the weight of each index is multiplied by the weight of each indicator (Table 3). In this way, this paper finds the specific physical fitness of each player. In this paper, the method of percentile is used to establish athletes' specific physical fitness evaluation index. In this way, the exceptional physical fitness of Chinese tennis players can be comprehensively evaluated.

DISCUSSION

This paper comprehensively screened the indicators of physical fitness evaluation of young tennis players. In this paper, the selected indexes are weighted and calculated to obtain the correlation between the indexes.⁸The various stages of physical fitness assessment for young tennis players are essential in determining the final result. The two are

	Male	Female
5 points (excellent) (above)	4.2	3.98
4 points (good)	3.61-4.19	3.74-3.97
3 points (medium)	2.64-3.61	2.58-3.73
2 points (bottom)	2.17-2.63	2-2.57
1 point (poor) (below)	2.16	1.99

Table 1. General numerical model of the specific physical fitness index of tennis	players.
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Test index		Minimum (W/M)	Max(W/M)	Model value (M±SD)(W/M)
O control of the state	Left foot hexagon jump	11.58 / 10.63	35.05 / 30.42	17.66±4.75 / 17.93±5.88
Overall coordination	Right foot hexagon jump	12.63 / 11.26	36.32 / 29.68	18.46±4.6 / 18.38±5.69
	Turn left foot and run forward	2.87 / 2.78	4.13 / 4.09	3.37±0.31 / 3.32±0.34
Special coordination	Turn right foot and run forward	2.96 / 2.71	4.26 / 4.15	3.4±0.28 / 3.33±0.29
	Right arc and run forward	18.14 / 19.05	25.41 / 25.27	21.83±1.76 / 1.32±1.29
	5m sprint	1.12 / 1.07	1.49 / 1.6	1.28±1.02 / 2.25±0.16
Startup speed	10m sprint course	1.94 / 1.88	2.54 / 2.58	2.22±1.62 / 3.91±0.26
	20m sprint course	3.52 / 3.39	4.61 / 4.36	3.95±0.27 / 5.8±1.69
	Throwing a medicine ball over the head	2.64 / 3.07	7.84 / 9.16	5.37±1 / 7.48±2.41
Specialized power	Forehand closed footwork medicine ball toss	2.03 / 3.73	8.85 / 11.89	6.44±1.44 / 7.2±2.16
	Backhand closed footwork medicine ball toss	1.99 / 3.68	8.74 / 11.37	5.99±1.18 / 1.88±0.24
	vertical high jump	1.33 / 1.47	2.16 / 2.43	1.8±2.07 / 5.35±0.89
Fast power	single leg triple jump	3.53 / 3.87	6.26 / 7.28	4.94±0.72 / 20.31±1.24
	Sit on your back	2.11 / 2.11	37.89 / 47.37	14.76±8.56 / 12.8±7.93
Door strop sth	Left knee bent	2.11 / 1.05	29.47 / 30.53	11.66±9.41 / 12.31±7.97
Base strength	Right knee bent	2.11 / 1.05	33.68 / 32.63	11.49±9.72 / 15.44±9.23
	Lie on your back	1.05 / 2.11	28.42 / 29.47	13.71±7.75 / 3.95±2.02
Core power	Eight-level abdominal bridge	2.11 / 1.05	8.42 / 8.42	3.73±2.07 / 7.47±2.34
Aerobic fitness	Beep-Test	2.95 / 3.89	10.95 / 12.21	7.42±1.93 / 25.53±2.21
Anaerobic fitness	Doubles line back run	22.32 / 21.73	30.43 / 29.4	26.08±2.06 / 1.8±0.44
Body Function	rotational stability	1.05 / 1.05	3.16 / 2.11	1.8±0.48 / 2.27±0.55
lower extremity functional ability	emity functional ability Straight leg active lift		3.16 / 3.16	2.63±0.61 / 3.02±0.36

Table 2. Scores and evaluations of individual items of Chinese professional tennis players.

Evaluation indicators	5 points (excellent) (below)	4 points (good)	3 points (medium)	2 points (bottom)	1 point (poor) (above)
Left foot hexagon step (S)	12.52 / 12.13	12.53-14.32 / 12.14-13.16	14.33-21.08 / 13.17-22.42	21.09-23.17 / 22.43-27.37	23.18 / 27.38
Right foot hexagon step (S)	13.16 / 13.01	13.17-15.26 / 13.02-13.58	15.27-20.97 / 13.59-23.42	20.98-24.01 / 23.43-28.16	24.02 / 28.17
Turn left and sprint forward (S)	3.01 / 2.89	3.02-3.14 / 2.91-3.06	3.15-3.46 / 3.07-3.56	3.47-3.81 / 3.57-3.84	3.82 / 3.85
Turn right and sprint forward (S)	3.04 / 2.98	3.05-3.19 / 2.99-3.11	3.2-3.63 / 3.12-3.54	3.64-3.76 / 3.55-3.75	3.77 / 3.76
Retreat (S)	19.31 / 19.47	19.32-20.54 / 19.48-20.04	20.55-22.85 / 20.05-22.38	22.86-24.49 / 22.39-23.75	24.51 / 23.76
5 meters short distance (S)	1.15 / 1.15	1.16-1.2 / 1.16-1.22	1.21-1.35 / 1.23-1.4	1.36-1.45 / 1.41-1.52	1.46 / 1.53
10m short distance (S)	2.01 / 2.06	2.02-2.08 / 2.07-2.14	2.09-2.35 / 2.15-2.37	2.36-2.45 / 2.38-2.44	2.46 / 2.45
20 meters short distance (S)	3.62 / 3.54	3.63-3.75 / 3.55-3.76	3.76-4.21 / 3.77-4.09	4.22-4.31 / 4.11-4.29	4.32 / 4.31
Rotational stability (Sc)	3/3		2		1
Straight Leg Up Active Lift (Sc)	3/3		2		1
Shoulder flexibility (Sc)	3/3		2		1

both independent and interrelated. The success of the previous stage determines the ultimate goal.

This paper screened the comprehensive quality evaluation indicators of outstanding domestic players. The selection of the weight of each index and the application of the evaluation index in actual teaching aim to construct a particular physical fitness training index system for outstanding Chinese athletes.⁹ This paper adopts the Delphi method for expert scoring. Combined with factor analysis, a relatively complete and comprehensive evaluation index of special physical training for Chinese tennis players was established. The particular physical fitness evaluation indicators of outstanding tennis players include strength, speed, agility, endurance, and flexibility. This paper constructs five standards of 1, 5 levels, and an exceptional level with different weight coefficients according to individual extraordinary physical fitness levels. The research results of this paper have laid a good foundation for the formulation and development of tennis player training plans in the future.

CONCLUSION

From the evaluation indicators and weighting factors of the particular physical fitness of Chinese tennis players, the main factors of tennis are coordination, agility, and quick strength. The main factors are anaerobic endurance, core strength, and strength endurance. Cofactors include aerobic and functional exercise. Coaches need to carry out physical and technical exercises according to adolescents' psychological development characteristics and specific physical fitness factors. Athletes need to emphasize coordination, agility, rapid strength, core strength, and coordination strength in their daily training. At the same time, athletes need to focus on the exercise of aerobic endurance, agility endurance, and balance ability.

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