Fuzzy correlation analysis-based Chinese professional tennis management system development research

Liang Li
College of Physical Education, Wuhan Institute of Physical Education, Wuhan
430079, Hubei, (CHINA)

ABSTRACT

Chinese tennis started later, development was relative stable, though it was recognized by many Chinese, it still not yet arrived at rapidly development track. In the environment of 21st century, China not only need to develop economy, but also should improve concern over Chinese sports, because current international competition is the competition of comprehensive national strength. Under contemporary environment background, the paper firstly utilizes statistical analysis and numeric analysis, from Chinese professional tennis athlete gender proportion, professional athlete age phase distribution, it is clear that Chinese female professional tennis athlete proportion further enlarges, and gets excellent result; secondly, from contemporary Chinese professional tennis players ranking in WTA, it finds that though Chinese tennis strength has some improvements, comparing to Russia and others numerous tennis powers, gap is still very significant; finally, applies fuzzy correlation analysis method, it analyzes Chinese tennis sound rapid development influence factors, and points out coaches' levels, fields investment, China's adolescent early period cultivation and potentials exploitation, age structure, players' cultural qualities and physical qualities as well as others are important influence factors that affect Chinese tennis development, which provides some references for Chinese tennis development.

KEYWORDS

INTRODUCTION

Tennis as a newly developed ball event, it emerged in France as earliest, till the early 20th century, it just came to China, Chinese professional tennis has constantly moving forward, from early period infancy to middle period tortuous rising phase, then to current development phase, is gradually recognized by national people. Therefore in contemporary national conditions, it studies professional tennis's athletes' age, gender, and athlete future development and so on.

Dai Hong-Lei in "Chinese professional tennis tournaments development research", carried on investigation and research from Chinese tennis development, made concrete analysis of Chinese professional tennis numerous aspects, he pointed out though Chinese tennis was recognized by masses, professional levels promoted, national concerns increased, it still had problems as high technical contents and limited fields and so on. And meanwhile, he also put forward his relative opinions, suggestions and solution methods.

Chen Xi in "Professional tennis system study", took contemporary Chinese people cognition degree on tennis, concerns about professional tennis tournaments as main research orientations, by comparing different groups' different recognition performances and concerns, he further got that only increased tennis publicity and masses understanding extent on tennis, let tennis system to get closer to masses then Chinese professional tennis could develop.

Li Si-Long in "Exploration on Professional tennis tournaments' game rhythm regulation", by researching professional tennis tournaments, took professional tennis game rhythm regulation as main research orientations, and further got conclusion. The paper pointed out: professional tennis was a kind of fierce competitive race activity, required technical contents and physical quality requirements were higher, professional players should grasp game rhythm and physical energy control status, which was most important parts in tennis tournaments.

By repeatedly investigation and researching, consulting literatures and investigating tennis circles coaches, researchers status and so on, the paper gets research information, analyzes Chinese professional tennis management system mechanism innovation pattern under contemporary China's conditions, so that gets conclusions, and provides references for Chinese tennis development.

PROFESSIONAL TENNIS STATUS

Professional tennis's genders proportions

Contemporary professional tennis is mainly a men's event, but with economic development, scientific and technological progress, and concept of everyone equal throughout society, it lets Chinese professional tennis's female teams are also expanding, below TABLE 1 is Chinese professional tennis gender distribution table :

TABLE 1 : Chinese professional tennis gender distribution table in 2014

Gender	Man	Woman
Distribution	43%	57%

By above TABLE 1, it is clear that by these years development, women professional tennis players are increasing, and speed is faster than men, by analyzing and studying the table, it draws Figure 1.
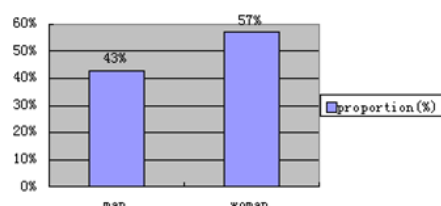

Figure 1 : In 2014 China's professional tennis gender on that

From above bar Figure1, it is clear that in professional tennis, women amount is obviously increasing, and currently women amount has already surpassed that of men in professional tennis, it also further increased in contributions to country in today, which makes a good start for Chinese tennis.

Age distribution of Chinese tennis players transferring to professional athletes

In every sports event, age is one of the most important factors, tennis has no exception, in tennis event, due to bigger physical power and arm power are needed, there are certain limitations in age, in order to convenient to study, below TABLE 2 is data that extracts from China's statistics yearbook:

TABLE 2 : Chinese tennis excellent athletes amount

Age	Woman athlete	Age	Man athlete
13 years old	20.3%	13 years old	14.4%
14 years old	46.5%	14 years old	35.6%
15-16 years old	18.2%	15-16 years old	36.7%
Above 16 years old	15.0%	Above 16 years old	13.3%

In order to better observe Chinese professional tennis excellent athletes different age phases changing trend and development trend, it draws following Figure 2 and Figure 3:
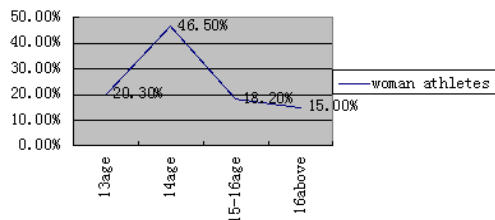

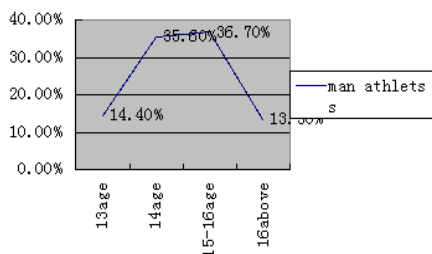**Figure 2 : Chinese female tennis player to professional athletes' age**

Figure 3 : Chinese male tennis player to professional athletes' age

From above athletes age distribution status, finally it gets that in women athletes, nearly half people are professional athletes when they are 14 years old, and men athletes mostly become professional athletes in 14-16 years old such a phase, which provides references for Chinese future finding out correct age phases, giving adolescent sports potentials into play and cultivating excellent athletes to win glory for motherland.

Recent years' world main tennis international WTA year-end top 50 number of people

WTA is called international women's tennis association, here it represents a nation's women professional tennis level, below TABLE 3 is recent three years' WTA table.

Above TABLE 3 represents Chinese women professional tennis strength in international, in order to further compare China's position in international, by statistics, it draws following Figure 4.

TABLE 3 : Recent three years' world main tennis countries WTA year-end Top 50 number of people

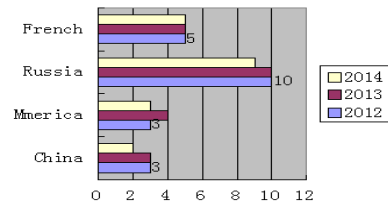|	2012	2013	2014
China	3	3	2
America	3	4	3
Russia	10	10	9
France	5	5	5

Figure 4 : The world's major WTA tennis country 50 number before year-end

By above bar Figure 4, it can intuitional get conclusion: in recent three years, Russia still occupies dominant position in tennis circles, and China development in recent three years are relative steady, strength is relative weak, which to be further improved, it rings alarm bell for Chinese tennis.

Chinese main tennis athletes' recent years' professional matches' rankings

In recent years, Chinese concerns on tennis are gradually promoting, Chinese professional tennis management system and institution are also heading for perfection, due to these improvements, it propels to China to generate a group of excellent athletes, below TABLE 4 are athletes recent years' rankings.

TABLE 4 : Main tennis athletes professional matches' rankings

	2011	2012	2013	2014
Li Na	23	29	23	18
Zheng Jie	33	163	25	28
Yan Zi	166	60	28	326
Peng Shuai	56	46	40	48

According to specific investigation, for the convenience of each circle scholars and experts study on Chinese professional tennis, it draws following broken line Figure 5, and makes comparison.
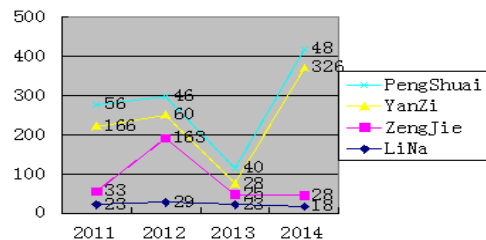

Figure 5 : Main tennis player career games ranked in recent years

By above Chinese several main excellent athletes' broken line Figure 5 comparison, it gets conclusion: in recent years, China's tennis reformation effects are remarkable, Li Na, Zheng Jie such excellent athletes' levels are increasing by year, but it has two-stage shortcomings, and nation should put more emphasis.

Adolescent tennis athletes' cultivation status

Adolescent is future of a country and flower of motherland. After all, future countries competition is competition of adolescent, adolescent is strong then country will be strong, adolescent is ambitious then country will be ambitious, therefore it studies China's adolescent professional level development influential important factor coaches.

TABLE 5 : Adolescent coaches' education background statistical table

	Graduate student and above	Undergraduate course	College	High school and below
Number of people	5	17	30	1
Proportion	7%	35%	56%	2%

According to above TABLE 5, it studies China's adolescent coaches' education background, in order to make it more specific, now draw it as following pie Figure 6:
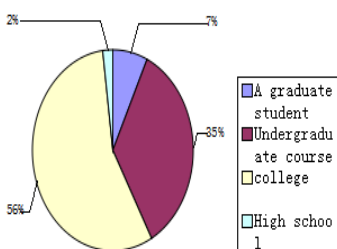

Figure 6 : Adolescent coaches' degree in statistics

From above pie Figure, it gets: most coaches concentrate on college education background, so it exposes coaches' low education background status, therefore coaches with education background of undergraduate course and above are China future dedicated orientation, it must promote coaches' professional qualities and technological level.

Only continuously research and summarize, by experts and coaches' constantly evaluation and research for years on Chinese current stage tennis athletes, and then formulate concepts and targets of excellent athletes cultivation that conform to China's national conditions, below TABLE 6 and TABLE 7 are experts, coaches' evaluation table statistics:

TABLE 6 : Whether adolescent tennis athletes cultivation ideas are reasonable or not

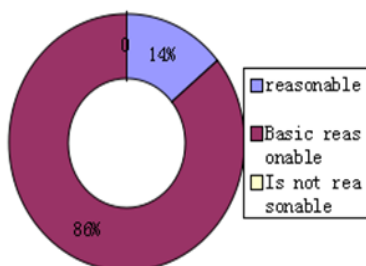|	Reasonable	Basic reasonable	Is not reasonable
Experts (seven people)	1	6	0
Proportion	14%	86%	0

Figure 7 : Adolescent tennis athletes training ability questionnaire

TABLE 7 : Whether adolescent tennis athletes cultivation ideas are reasonable or not

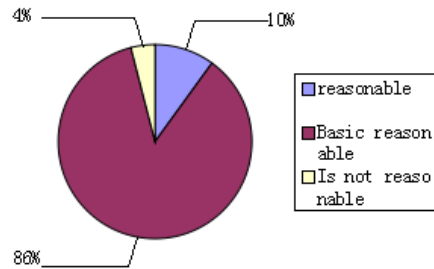|	Reasonable	Basic reasonable	Is not reasonable
Coaches (50 people)	5	43	2
Proportion	10%	86%	4%

Figure 8 : Adolescent tennis athletes training ability questionnaire

From above two pie Figure7 and Figure 8 analysis, it can get conclusion: contemporary scholars are basic satisfied with China current stage tennis aspect adolescent cultivation ideas and targets, which shows it also have great promotion space, Chinese professional level is to be promoted, which provides conditions for Chinese tennis development.

ESTABLISH MODEL

Data processing and result

Correlation analysis calculation formula is as following:

$$\rho(X,Y) = \frac{\operatorname{cov}(X,Y)}{\sigma_x \sigma_y} = \frac{E\big((X-\mu_x)(Y-\mu_y)\big)}{\sigma_x \sigma_y}$$

Among them, covariance is used as numerator, is product of two variables standard deviation, and it requires two variables standard deviation not to be 0.

And $\mu_x = E(X), \sigma_X^2 = E(X-\mu_x)^2 = E(X^2) - E^2(X)$

Therefore, Pearson correlation coefficient can also be written as:

$$\rho(X,Y) = \frac{E(XY) - E(X)E(Y)}{\sqrt{E(X^2) - E^2(X)}\sqrt{E(Y^2) - E^2(Y)}}$$

TABLE 8 : Data correlation

	Control variable	World ranking	Per capita GDP	Reserve talents	High grade coaches numbers	Field construction
	Pearson correlation	1.000	.154	.855	.705	-.210
World ranking	Significance (bilateral)	.	.836	.660	.365	.215
	df	0	2	2	2	2

By above data TABLE 8, it can get conclusion: reserve talents' number of excellent talents correlation coefficient is the largest one, secondly is number of high grade coaches, which shows that in

Chinese professional tennis development numerous influence factors, reserve talents play crucial roles, therefore nation mush focus on cultivation on Chinese reserve talents.

Define evaluation indicator set
According to:

$$U = \{u_1, u_2, \cdots, u_m\}, m = 1,2,3,$$

Evaluation indicator set is ={Reserve talents、high grade coaches qualities、field construction}.

Define evaluation grade set
According to:

$$V = \{v_1, v_2, \cdots, v_n\}, n = 1,2,3,4$$

Tennis development evaluation grade set is ={Very good, good, general, bad}.

Define each evaluation indicator weight
Weight mainly expression method is:

$$w = \{\mu_1, \mu_2, \cdots, \mu_m\}, m = 1,2,3$$

Among them: $\sum_{m=1}^{6} \mu_m = 1$

$$w_i = \frac{\dfrac{C_i}{\overline{S_i}}}{\sum_{i=1}^{n} \dfrac{C_i}{\overline{S_i}}}, (i = 1,2,\cdots,m)$$

Among them, w_i is evaluation parameter i monitoring value; $\overline{S_i}$ is evaluation parameter i standard arithmetic mean value of m grade, then weight set is:

$$w = \{w_1, w_2, \cdots, w_m\}_{\circ}$$

Here, apply normalization method to calculate weight, result is : $w = \{0.5, \quad 0.3, \quad 0.2\}$

Define evaluation matrix
Comprehensive evaluation matrix R evaluation method is mainly experts' evaluation method, membership function method. In order to let calculation result to be more accurate, here use membership function method, define fuzzy relation matrix R, from which: $R = (R_1, \quad R_2, \quad R_3)^T$
Evaluation grade on the 1 grade:

$$\mu_{i1(u_i)} = \begin{cases} 0 & u_i \geq v_{i2} \\ -\dfrac{u_i - v_{i2}}{v_{i2} - v_{i1}} & v_{i1} < u_i < v_{i2} \\ 1 & u_i \leq v_{i1} \end{cases}$$

Evaluation grade on the j grade:

$$\mu_{ij(u_i)} = \begin{cases} 0 & u_i \le v_{ij-1} \text{ or } u_i \ge v_{ij+1} \\ \dfrac{u_i - v_{ij-1}}{v_{ij} - v_{ij-1}} & v_{ij-1} < u_i < v_{ij} \\ -\dfrac{u_i - v_{ij+1}}{v_{ij+1} - v_{ij}} & v_{ij} \le u_i < v_{ij+1} \end{cases}$$

Evaluation grade on the n grade:

$$\mu_{in(u_i)} = \begin{cases} 0 & u_i \le v_{in-1} \\ \dfrac{u_i - v_{in-1}}{v_{in} - v_{in-1}} & v_{in-1} < u_i < v_{in} \\ 1 & u_i \ge v_{in} \end{cases}$$

It can solve each evaluation parameter membership to each evaluation grade, and then construct fuzzy relation matrix R.
Calculation result:

$$R_1 = (0.6, \quad 0.3, \quad 0.1); R_2 = (0.7, \quad 0.2, \quad 0.1); R_3 = (0.6, \quad 0.25, \quad 0.15)$$

Carry on comprehensive evaluation
Known $W = (\mu_j)_{1 \times m}$, $R = (r_{ji})_{m \times n}$, by:

$$S = w \circ R = (\mu_1, \mu_2, \cdots, \mu_m) \circ \begin{pmatrix} r_{11} & r_{12} & \cdots & r_{1n} \\ r_{21} & r_{22} & \cdots & r_{2n} \\ \vdots & \vdots & \vdots & \vdots \\ r_{m1} & r_{m2} & \cdots & r_{mn} \end{pmatrix} = (s_1, s_2, \cdots, s_n)$$

That:

$$s_k = \min\left(1, \sum_{j=1}^{m} \mu_j r_{jk}\right), k = 1, 2, \cdots, n$$

Input above calculation result into above formula and can get: $S = (0.45, \quad 0.37 \quad 0.18)$

Get conclusion
By fuzzy evaluation set $S = (0.45, \quad 0.37 \quad 0.18)$ it is clear: $M = \max(S_1, S_2, \cdots, S_n) = 0.45$

Therefore, in contemporary China, reserve talents are most important factors to propel to Chinese tennis rapidly progress. Whether Chinese tennis can still stand in the rising nations in the world, the key is up to how to expand Chinese reserve talents strength, how to promote excellent talents qualities, how to promote athletes technical levels, how to let athletes to receive lecturing and training with playing method fit for themselves and others, all are problems that we should consider, only in this way then can let Chinese tennis to constantly move forward.

CONCLUSION

Firstly according to contemporary national conditions' professional tennis players genders, age phases distribution, and Chinese player' recent three years rankings in international WTA, the paper gets Chinese professional tennis development status in recent years, its development is relative gentle, which is to be further improved, and meanwhile it puts forward precious opinions about China how to reform. Secondly, it carries on further studies on adolescent cultivation, tennis coaches' education background, experts management ideas and targets on contemporary adolescent, analyzes and gets: current stage Chinese coaches' comprehensive qualities are lower, adolescent basic knowledge is not firm, and proposes solution countermeasures. Finally by fuzzy correlation analysis method, it analyzes some main factors that affect Chinese excellent athletes amount and quality, from which reserve talents' excellent athletes proportions have maximum impacts, according to research result, the paper puts forward that nation should reinforce cultivation and education on Chinese adolescent, increase equipments, faculty investment so as to cultivate tennis masters of new generations.

REFERENCES

[1] Xu Bo, Xie Tie-tu; A Study on the Landslide of China's Competitive Basketball Games and Countermeasures. Journal of Beijing Sport University, **5(5)**, 101-105 **(2010)**.

[2] Ia Dong-chen; Countermeasure and Causation of Imbalance of Teams Athletic Competence in CBA. Journal of Hebei Institute of Physical Education, **23(1)**, **(2009)**.

[3] Huang Song-feng; Research on the Countermeasures for Chinese Man's Basketball Team in London Olympics. China Sport Science and Technology, **47(1)**, **(2011)**.

[4] Chen Jun, Shi Yan; A Countermeasure Study about Realizing Sustainable Development of Basketball Professionalism in China. Journal of Beijing Sport University, **25(3)**, 301-302, 308 **(2002)**.

[5] Jia Ning, Sun Han chao; Objectives of developing the Chinese competitive sports of the early 21st century and studies of the countermeasures. Journal of Wuhan Institute of Physical Education, **35(6)**, 1-4 **(2001)**.

[6] Wang Yun, Cheng Yao; Strength Pattern of Current World Man's Basketball from the View of 15th World Mans Basketball Championships. China Sport Science and Technology, **43(4)**, 77-81 **(2007)**.

[7] Xue Haitao; A Study of the Causes and Countermeasures of the Decline of Competitive Basketball in China. Bulletin of Sport Science & Technology, **21(2)**, 26-27 **(2013)**.

[8] Ma Jinrong, Gong Shijun; Some Problems of WCBA League Teams and Foreign Main Centre. Journal of Shenyang Sport University, **31(3)**, 84-88 **(2012)**.