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Grey relational degree method-based badminton development research

Shaowei Dong, Qiusheng Guo*

Physical Education Department, Harbin University of Science and Technology, Harbin 150080, Heilongjiang, (China)

ABSTRACT

Badminton is a kind of large-scale national fitness kind sports event, it integrates appreciation, self-entertainment and exercise, is favored by broad masses. Therefore, research on badminton has very important significance in further developing Chinese sports and expanding its impacts. The paper starts from participated mass badminton participation ways, participation population age structure and population education background features, it studies mass badminton recent situations, points out that Chinese badminton has already been known by most of people, almost whole public joint into badminton exercising. Secondly, it analyzes Chinese badminton recent development, gets that Chinese badminton overall level is higher and has better performance in Olympic Games by comparing to other world sports powers. And utilize grey relational degree method to further analyze badminton striking and smashing technique relations with scoring rate and lose rate, by comparing correlation values, it gets that “smashing”, “lifting”, “blocking” are the main techniques, to get higher scores, it should master the craft of “smashing”, “lifting” and “blocking” techniques, meanwhile focuses on “net receiving”, “intercepting”, “high lobbing”, “hooking” and other techniques. © 2014 Trade Science Inc. - INDIA

KEYWORDS

Badminton;
Grey relational degree method;
Strike and smash technique;
Physiological indicators.

INTRODUCTION

With comprehensive organization of national fitness events, badminton has already become one of most popular fitness events, badminton has been widely spread in China, and gradually become the focus of comprehensive fitness and sports industry as well as fitness entertainment industry. And scholars' development researches on badminton have also never ceased. Guan Li, in the research of Chang Chun ordinary high school badminton, he combined with lots of documents, carried out fact-finding questionnaire survey, obtained first hand information, put forward current Chang Chun

ordinary high school badminton organization status, pointed out existing problems and given corresponding measures; Sun Yu-Ting, in the research of national fitness activities, she pointed out badminton had very important public values, no matter in sports training or leisure entertainment aspect, all were favored by the public and put forward it should positive impel to badminton impacts on public life in future stage; Li Mei, in the research of badminton, he pointed out that badminton had very important body building values, it not only was a sports event, but also played certain roles in citizens physical health, is one of significant exercise events to improve national physical quality some time in future;

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Zhong Jian-Ping, in the research of Chinese excellent badminton players, by documents literature, logical analysis, mathematical statistics, she analyzed Chinese excellent badminton players training stage features, and presented multiple influence factors, specific analyzed individual factor and player training's connections, so that developed problems and presented corresponding measures; Wu Jia-Duo, in the research of Chinese excellent juvenile badminton players, he pointed out that players' psychological features were main factors that affected their performance, improved one player overall level should consider his psychological quality so that let him to better perform in the competition.

The paper firstly researches on mass badminton recent status, specific analyzes participated mass badminton participation ways, participation population age structure and population education background features, and analyzes Chinese badminton development, utilizes grey relational degree method, further analyzes badminton striking and smashing techniques relations with scoring rate and loss rate, and compares correlation values, it gets that "smashing", "lifting", "blocking" are the main techniques, to get higher scores, focuses on combination with "net receiving", "intercepting", "high lobbing", "hooking" and other techniques so that gets higher performance.

MODEL ESTABLISHMENT

From above frame Figure 1, it is clear that badminton organization suffers multiple factors influences. In macroscopic view, it suffers economy, system, regional culture and others influences, its development degrees are not the same; in microscopic view, badminton player himself quality is the key factor, from which it includes physical quality, psychological quality, technical level and cultural level so on, while for other external causes, as

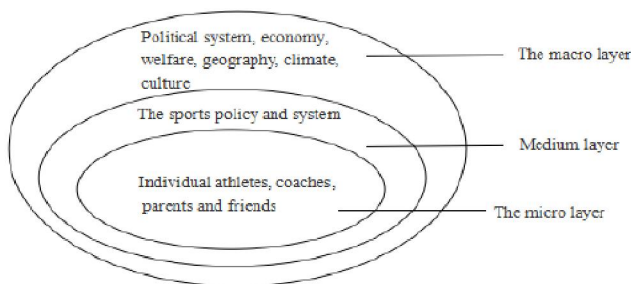


Figure 1: Factors influencing the badminton success model

coach factor, stadium construction, capital outlay and so on, which are also main factors that affect badminton development. In a word, develop badminton should comprehensive consider numerous factors, start from macroscopic and do a good work in microscopic.

Chinese mass badminton recent status

Badminton is a kind of mass leisure and entertainment sports event, and as best choice of physical training in mass life and widely spread. In living area, school playground, even in offices, it can find the shadow of badminton all the time. Badminton has already become an indispensable event in mass life, as old as the old man that above seventy, while as young as preschool children, all can master badminton essentials. It is clear that badminton has been widely spread in China.

As a kind of large-scale mass activity, badminton sports forms are various, mass participation degrees are different from each other, from which they mainly exercise together with colleagues and friends, while participate with individual form, training courses and clubs also occupy certain proportions. To comprehensive analyze Chinese mass badminton participation status, now use Chinese statistical yearbook and national sports bureau statistics as following investigation data, and draw into pie Figure 2, analyze result:

By above pie Figure 2 analysis, it can get: Chinese mass participation in badminton are mainly exercising together with colleagues, friends and family that accounts for 42.6% of total number of people, secondly is participating in training courses and clubs that account for 15.4%, besides, it has also other types participating in badminton exercise that accounts for 10.2%.

At present, badminton has already widely spread in China, and is favored by masses, badminton population has rapidly increased. Research on badminton sports population status, from which it includes Chi-

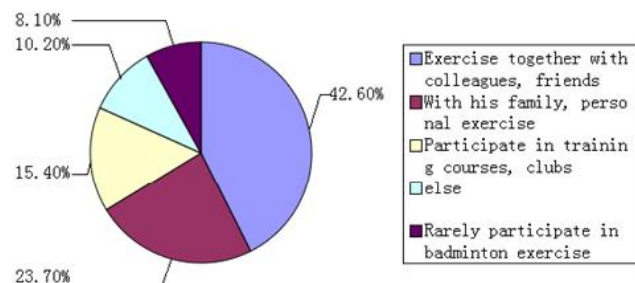


Figure 2: Mass badminton participation

nese badminton population education background and age features, it has very important significances in further organizing badminton, analyzing current badminton development and existing problems, as well as expanding badminton impacts in China, correlation data is as TABLE 1 and TABLE 2.

TABLE 1 : Badminton population education background feature table

	Graduate student	University (college)	Technical secondary school	Junior high school	Primary school	Almost illiterate
Proportion%	12.3%	67.8%	14%	4.4%	1.3%	0.2%

TABLE 2 : Badminton population age structure feature table

Age/ years old	<16	16~25	26~35	36~45	46~55	>55
Proportion%	3.9%	31.5%	43.5%	15.6%	5.5%	1.6%

Below Figure 3 and Figure 4 are Chinese badminton population education background and age features comparison diagrams, data is from general administration of sport of China, Chinese statistical yearbook relative investigation reports.

By above ring statistics Figure 3, it is clear:our country badminton population is mainly with university back-

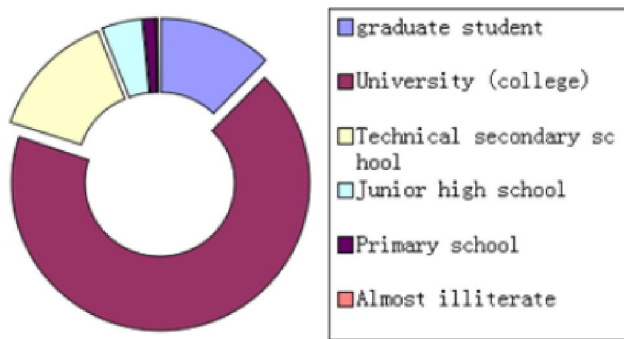


Figure 3 : China's badminton population education characteristics

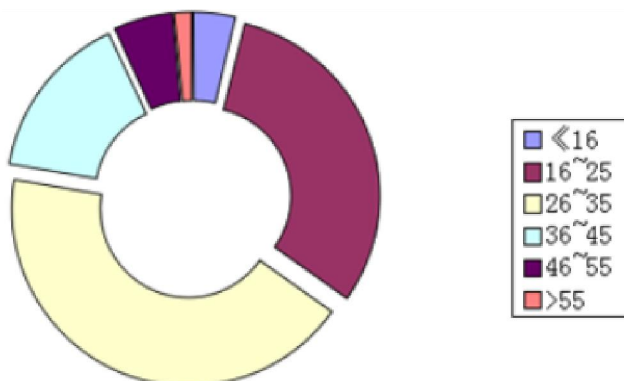


Figure 4 : China's badminton population age characteristics

ground, secondly is technical secondary school, which also decides population age distribution in badminton engagement is 16~25years old, 26~35years old. It is clear that badminton is favored among university students and middle aged people, which has closely relations with their life style, ideas and physical quality. To

promote badminton nationally organizing, it should positively encourage primary and secondary students to go in for badminton, start from foundation so that make contributions to national fitness organization.

Chinese badminton development

By above analysis, it is clear that Chinese badminton has already comprehensive developed in mass. And as a kind of sports event, badminton performance in competitions cannot fall behind other world powers.

In recent years, Chinese badminton grade players are rapidly developing, so that further promote our country badminton development, let our country's badminton to get further improved in world sports position. Below TABLE 3 is year 2008~2012 Chinese badminton grade players' development status, data is from Chinese statistical yearbook.

By mathematical statistics, draw above TABLE 3 data into following broken line Figure 5, analyze and get conclusion:

From above broken line Figure 5, it gets conclusion:at present, our country badminton grade players total amount has declined, from which international athletes are increasing, but masters of sports, first grade sportsmen, and second grade sportsmen reduce,

TABLE 3 : Badminton grade players' development status table

Years	Total	International athlete	Master of sports	First grade sportsman	Second grade sportsman
2008	929	1	8	237	683
2009	915	1	11	228	675
2010	897	1	14	215	667
2011	618	5	32	148	433
2012	627	5	28	83	511

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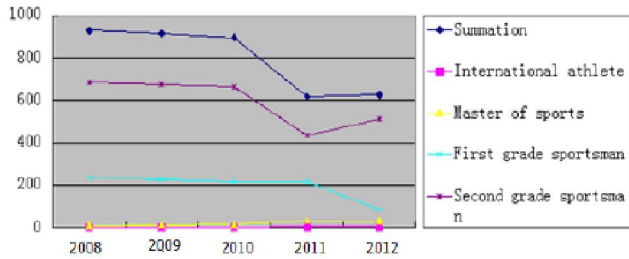


Figure 5 : Badminton class player development line chart

and second grade sportsmen declining range is the largest. It is also one of problems that current Chinese badminton needs to be solved, it should be taken seriously.

Coach plays key roles in a team; research coach’s development status can make relative suggestions for improving team overall quality, perfecting team management. According to investigation, Chinese badminton coaches overall quality is higher, most of coaches are with medium or higher level professional titles. Below Figure 6 and Figure 7 is Chinese badminton coaches’ basic information, data is from general administration of sport of China and internet data.

From above bar-type Figure 6 and Figure 7, it can get conclusion: Most of Chinese badminton coaches are in middle and higher ranking, education background is mainly university. Coaches with national level and graduate student education background are relative fewer, but overall quality is relative higher. To further promote Chinese badminton development, it should improve badminton coaches’ cultural quality and strengthen cultivate national level coaches on the basis of present, so that let Chinese badminton overall level get improved

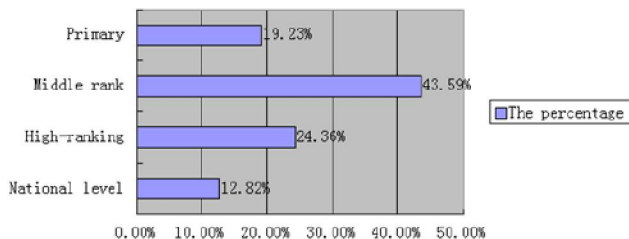


Figure 6 : The coach title information

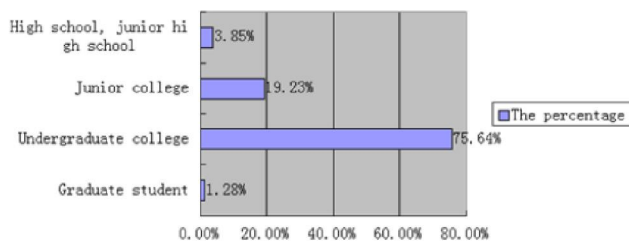


Figure 7 : The coach education information

on this basis.

On the basis of analyzing Chinese badminton players’ recent status, further research on Chinese badminton performances in Olympic Games, and further analyze Chinese badminton. Below Figure 8 is Chinese badminton performances statistical data during 1992~2012 Olympic Games, data is from general administration of sport of China badminton management center relative documents.

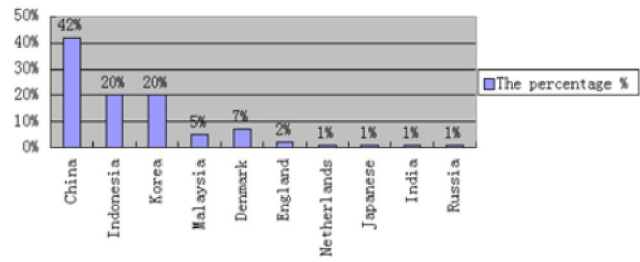


Figure 8 : The performance of China’s badminton at the Olympics

By above bar-type Figure 8, it can get conclusion: By far, Chinese badminton takes leading role in world major countries; its Olympic performances are also gratifying. Such results cannot get without Chinese badminton national organizing. On the premise of national sports organizing, badminton has already become a kind of mass event, no matter the old or children, students or workers, all can master badminton basic motions’ essentials. And, currently Chinese badminton has been rapidly developed, especially for international athletes that have already improved. All of these make contributions to Chinese badminton Olympic Games performances.

Grey relational degree method-based Chinese badminton player’s striking technical research

On the basis of researching on Chinese badminton development status, it is clear that nowadays Chinese badminton has been rapidly developed; its position in world badminton has been raised. To quantitative analyze Chinese badminton players’ technical level, further raise Chinese badminton international level, it uses mathematics grey relational degree method to make researches on Chinese badminton players’ scoring, losing status, so that gets relative conclusions. Below TABLE 4 is data from international general administration of sport and relative documents consulting:

Grey relational analysis is using computation factor

TABLE 4 : Striking technical scoring and losing rate status

Striking technique	Used percentage%	Scoring rate%	Losing rate%
Smashing	23.43	37.72	12.64
Lifting	10.23	4.12	14.84
Blocking	9.31	2.26	14.64
Net receiving	7.6	2.66	11.33
Intercepting	6.91	9.83	4.71
High lobbing	6.86	6.51	7.12
Hooking	6.17	4.78	7.22
Rushing	4.8	7.97	2.41
Pushing	4.8	6.51	3.51
Driving	4.63	3.59	5.42
Driving clear	3.83	2.52	4.81
Net blocking	3.14	6.24	0.8
Placing	2.86	0.66	4.51
Service	2.63	2.52	2.71
Backhand dropping	0.69	0	1.2
High point placing	0.63	1.2	0.2
Killing	0.51	0.8	0.3
Backhand clearing	0.51	0	0.9
Low dropping	0.29	0	0.5
Clearing	0.11	0	0.2
Moving	0.06	0.13	0
Total	100	100	100

and research objects relational degree to analyze factors impacts on research objects, it is based on system overall development changes, if system changes and factor changes' trends are consistent, then the two correlation degree is larger; if system changes and factors changes' trends are inconsistent, or have certain differences, then the two correlation degree is smaller.

Establish model

(1) In badminton numerous striking and smashing techniques, select them that used percentage $\gg 5\%$ to analyze, record Chinese badminton striking technical factors feature behavior sequence as following:

$$x_i = (x_i(1), x_i(2), \dots, x_i(7))^T, i = 1, 2, 3, \dots, 7, \text{ by relative fac-}$$

tor line sequence, it can get:

$$x_i = \begin{pmatrix} 37.72 & 12.64 \\ 4.12 & 14.84 \\ 2.26 & 14.64 \\ 2.66 & 11.33 \\ 9.83 & 4.71 \\ 6.51 & 7.12 \\ 4.78 & 7.22 \end{pmatrix}$$

(2) Define reference sequence

Take Chinese badminton smashing technique used percentage sequence x_0 as reference sequence, that:

$$x_0 = (23.43, 10.23, 9.31, 7.6, 6.91, 6.86, 6.17)$$

(3) Initialization method data processing

Utilize formula $x_i(k) = \frac{x_i(k)}{x_i(1)}$ to handle with relative

factors line sequence, result is as following:

$$x_1(k) = \frac{x_1(k)}{x_1(1)} = (1, 0.11, 0.06, 0.07, 0.26, 0.17, 0.13);$$

$$x_2(k) = \frac{x_2(k)}{x_2(1)} = (1, 1.17, 1.16, 0.90, 0.37, 0.56, 0.57);$$

(4) Calculate

$$\min_{1 \leq i \leq 7} \min_{1 \leq k \leq 7} |x_0 - x_i(k)|, \max_{1 \leq i \leq 7} \max_{1 \leq k \leq 7} |x_0 - x_i(k)|$$

$$\text{Input } x_1(k) = (1, 0.11, 0.06, 0.07, 0.26, 0.17, 0.13),$$

$$x_2(k) = (1, 1.17, 1.16, 0.90, 0.37, 0.56, 0.57)$$

into above formula and get:

$$\min_{1 \leq i \leq 7} \min_{1 \leq k \leq 7} |x_0 - x_i(k)| = 28.46$$

$$\max_{1 \leq i \leq 7} \max_{1 \leq k \leq 7} |x_0 - x_i(k)| = 29.55$$

(5) Calculate Chinese badminton striking and smashing technique correlation coefficient

Correlation coefficient computational formula is as following:

TABLE 5 : Badminton striking and smashing grey relational degree value

	Smashing	Lifting	Blocking	Net receiving	Intercepting	High dropping	Hooking
Relational degree	1.861	1.859	1.857	1.848	1.837	1.821	1.810

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$$\zeta_i(k) = \frac{\min_{1 \leq i \leq n} \min_{1 \leq k \leq m} |x_0'(k) - x_i(k)| + \rho \times \max_{1 \leq i \leq n} \max_{1 \leq k \leq m} |x_0'(k) - x_i(k)|}{\max_{1 \leq i \leq n} \min_{1 \leq k \leq m} |x_0'(k) - x_i(k)| + \rho \times \min_{1 \leq i \leq n} \max_{1 \leq k \leq m} |x_0'(k) - x_i(k)|}$$

Among them, ρ is resolution ratio, and $\rho \in (0,1)$, $\rho = 0.5$, gets bigger and then relation is bigger.

Input $|x_0'(k) - x_i(k)|$ each value, and can solve:

$$\zeta_1 = (1.16, 1.74, 1.80, 1.94, 2.02, 2.01, 2.08);$$

$$\zeta_2 = (1.16, 1.81, 1.89, 2.01, 2.03, 2.05, 2.08);$$

(6) Calculate correlation degree

Use correlation degree computational formula

$$r_i = \frac{1}{m} \sum_{k=1}^m \zeta_i(k), \text{ input above computation value and}$$

get:

$$r_1 = 1.861, r_2 = 1.859, r_3 = 1.857, r_4 = 1.848, r_5 = 1.837, r_6 = 1.821, r_7 = 1.810$$

So that it gets badminton striking and smashing techniques' grey relational degree data TABLE 5 as following:

(7) Evaluation result

By above badminton striking and smashing techniques relational degrees, it is clear: Relational degree between "smashing" and badminton scoring rate is the largest, secondly is "lifting", "blocking", "net receiving", "intercepting", "high dropping" and "hooking". Combine with badminton player training technical research, it is clear that badminton player common used striking and smashing techniques are mainly "smashing", "lifting" and "blocking", and by above analysis, it is clear that the three techniques are also the most influential factors in badminton technical scoring. But to get better results, it should on the basis of adept in using these three techniques, combine with "net receiving", "intercepting", "high dropping" and "hooking" so on techniques, properly apply different techniques in different opportunities so that can win the badminton game.

CONCLUSION

The paper firstly researches on mass badminton recent status, starts from participated mass badminton participation ways, participation population age structure and population education background features, it mentions that current with national fitness events organizing, Chinese mass badminton organizing is relative

smoothly, badminton has already been well known by most of people, almost all public participate in badminton exercising. Meanwhile, it also builds mass base for Chinese badminton sustainable development, which provides powerful impetus for Chinese badminton impacting on world sports.

On the basis of researching mass badminton, it analyzes Chinese badminton recent development; it mainly includes badminton coaches, badminton players and their Olympic Games performance. By quantitative analyzing relative data, it gets that Chinese badminton grade players totally are in declining trend, but international athletes has increased; Most of badminton coaches are in middle and higher ranking, and mainly with university education background, overall level is higher, which leads to Chinese badminton have better performance in Olympic Games by comparing to other world sports power.

Make use of grey relational degree method, further analyze badminton striking and smashing techniques relations with scoring rate and losing rate, and by comparing correlation degrees, it gets that "smashing", "lifting" and "blocking" are the main techniques that have bigger correlation degrees with badminton player scoring rate. An excellent badminton player should be adept in mastering "smashing", "lifting" and "blocking" techniques, and focus on combination with "net receiving", "intercepting", "high dropping" and "hooking" so on techniques, so that can get high scores in competitions.

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