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Goal programming-based China's young women basketball players attack skill and method exploration

Wei Yin
Department of Sport, Shandong Sport University, Jinan 250102, Shandong, (CHINA)

ABSTRACT

As recent years large scale sports events that Chinese women's basketball attended have increased, research on tactical application status the main factor directly affects Chinese women's basketball development has also become a critical factor to propel basketball development. The paper analyzes results of interviewing and investigation, it finds that among these experts, around 50% are associate professors, and by studying different positions athletes' movement number, it discovers that basketball center has the most movement number, therefore, China oughts to cultivate more excellent centers to ensure fighting capacity of the whole team. It makes statistics of different positions athletes' scores and receiving status, it thinks that Chinese athletes' team spirits are stronger, but random response capacities are still to be further improved; utilizes SPSS software to make quantitative analysis of factors that affect Chinese young women basketball players comprehensive strength, and on this basis, makes use of goal programming and discriminant analysis method, establishes optimal principal-based Chinese woman's basketball comprehensive strength criterion model, by analyzing statistical data, it gets conclusion that strengthen speed training on women basketball players is the key to increase scores, only then can rapidly attack and defend.

KEYWORDS

Young women's basketball team; Optimal principal; Goal programming; Attack skill.

INTRODUCTION

The paper takes Chinese women's basketball team recent years participated women's basketball league matches as research objects, and proceeds with specific analysis and researches on Chinese women's basketball development. Below are Chinese relative scholars' studies in the field.

Chen Guang-Ya in the article "The 16th World championship Chinese and foreign women's basketball centers offensive features analysis and research", Chinese women's basketball performance in the world championship was the worst throughout the history, which also revealed Chinese women's basketball existing problems in attack field, especially in center, though Chinese women's basketball centers have certain advantages, they were inferior to foreign strong contingent in tackling speed, physical ability's endurance fields, it indicated that Chinese women's basketball should intensify training on their dribbling speed, random response capacities and other techniques at ordinary times training.

Su Miao-Qi in the article "The 15th world championship Chinese and foreign women basketball rear guard attack abilities comparative analysis and research", by researching and analyzing on them, she got that Chinese shooting guards had outstanding performance, they could get more scores in valid time and stance, but point guards sub-effectiveness in Chinese women's basketball was bad, response was slower and had more faults in the match, lost many scoring opportunities. Therefore, the paper suggested that it should reinforce Chinese women's basketball point guard break through and attack training so that improve whole scoring rate.

Shen Liang in the article "2004 to 2005 National women's basketball class A matches Hebei women's basketball team and other teams' gap analysis", through analyzing Chinese women's basketball class A matches, he found that Hebei women's basketball team's advantages over other teams were that Chinese Hebei players' centers breakthrough ability was stronger, and some players' attack speed, endurance and techniques performing were higher that had larger contributions to their team, which provided basic guarantee for China cultivating more excellent women basketball players.

The paper combines with scholars' research results, utilizes mathematical methods, and establishes relative models to build foundation for China women's basketball cultivating more excellent players in the future.

DATA ARRANGEMENT

By studying recent years' experts researches on mathematical models, it finds that mathematical models can handle with collected data, and further analyze data development trend and make prediction on future situations.

Interviewed basketball experts objects

By interviewing big and medium-sized cities every professional women's basketball team status, and through exchanging with relative coaches、scholars, it carries out specific analysis and research on Chinese women's basketball attack ways.

Below TABLE 1-3 is Chinese partial women's basketball teams attack ways statistical table, data is from national sports development and research investigation result announcement as well as general administration of sport of China.

TABLE 1 : Investigation objects specific status

Job title	Questionnaire object		Recovery status	
	Number of people	**account for total amount%**	**Number of people**	**Recovery rate**
Professor	5	19.02%	5	100%
Associate professor	15	46.2%	12	80%
Doctoral candidate	12	34.6%	9	75%

TABLE 2 : Evaluation on the survey

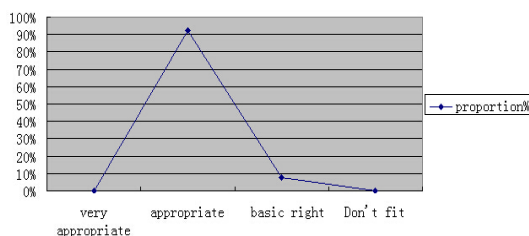| Validity	Very appropriate	Appropriate	Basic right	Don't fit
Quantity	0	24	2	0
Proportion	0%	92.3%	7.7%	0

Figure 1 : Evaluation on the survey

TABLE 3 : Chinese young female athletes' each position movement number

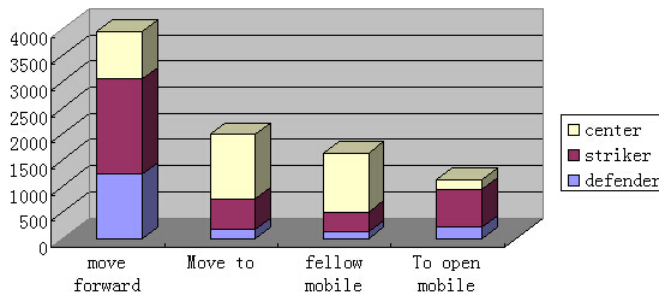|	Move forward	Move towards basket	Move towards fellow	Move towards vacancy
Defender	1230	170	123	212
Striker	1820	589	378	736
Center	900	1230	1122	183

Figure 2 : Young female athletes in our country the location of the mobile number

By above investigation, it finds (analysis as Figure 1 and Figure 2):Among investigated experts, 92.4% think that it is fit for Chinese young women's basketball research; and meanwhile they point out that defenders' number of movements in Chinese women's basketball is more that ensures goal rate.

Statistics of athletes score ways in the field

How to improve Chinese athletes' comprehensive levels and scoring rate is the upmost improvement orientation for current Chinese women's basketball, below TABLE 4 and Figure 3 are statistics of Chinese women's basketball score ways.

TABLE 4 : Chinese young female athletes' score ways statistics

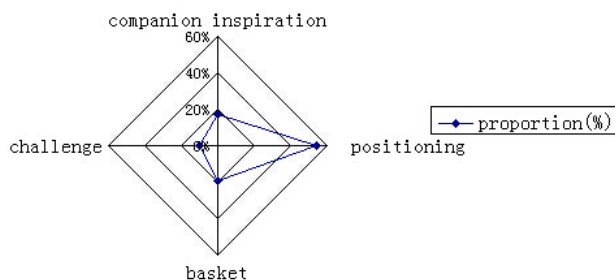|	Companion inspiration	Positioning	Scramble under basket	Challenge in the position
Number of people	27	78	30	21
Proportion(%)	17%	54%	19%	10%

Figure 3 : China's young female athletes score way of statistics

To let the paper to be more persuasive, it carries out study on Chinese women's basketball young players attack ways through investigating documents and interviewing scholars, relative data is as TABLE 5-6 and Figure 4-5.

TABLE 5 : Chinese young female athletes attack rebound acquiring ways statistics

Way of acquiring rebound	Times	Averagely per session	Proportion of total times%
Out rushed to rob	106	8.8	54.4%
Scramble under basket	37	3.1	19%
Challenge in the position	20	1.7	10.2%
By companion spot kicking	32	2.7	16.4%
Total	195	16.3	

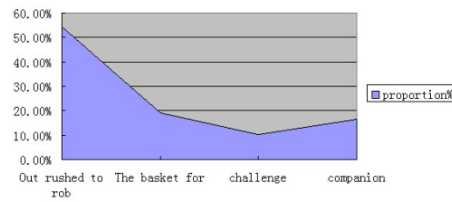**Figure 4 : China's young female athletes win offensive rebounds way statistics**

TABLE 6 : Chinese young female athletes' score ways statistics

	Free throw	2-point	3-point
Cast time	526	1226	492
In time	338	520	128
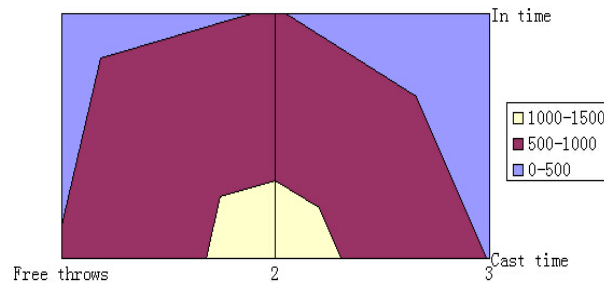
Figure 5 : Young female athletes score way statistics in our country

By analyzing, it finds that among Chinese young women's basketball, proportion of out rushed to rob's times is the largest, 2-point cast time has 1226 times that accounts for 50% of total amount.

Field athletes score ways statistics

In field athletes' performance evaluation ways, women's basketball players' receiving way is one of the main evaluation criterions, below TABLE 7-9 is statistics of Chinese women's basketball receiving ways, relevant analysis is as Fig ure 6-8.

TABLE 7 : Analysis of Chinese young female athletes' receiving ways

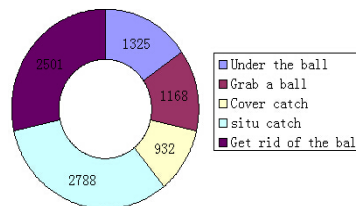| Type	Under the ball	Grab a ball	Cover catch	Situ catch	Get rid of and catch
Number of receiving	1325	1168	932	2788	2501
Proportion%	16%	14%	13%	30%	27%

Figure 6 : The young female athletes' returner analysis in our country

TABLE 8 : Chinese young female athletes' aggressive analysis

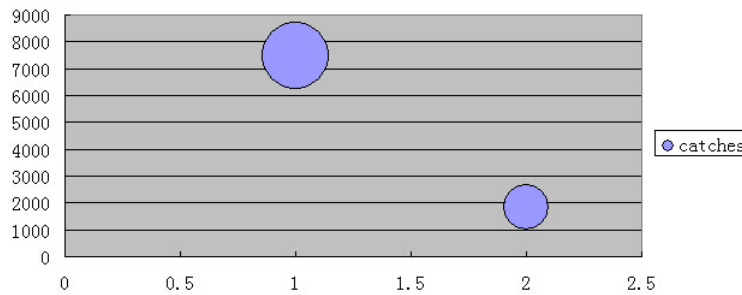| Type	Transitional receiving	Aggressive receiving
Number of receiving	7463	1827
Proportion%	67.7%	32.30%

Figure 7 : The young female athletes' aggressive analysis in our country

TABLE 9 : Chinese young female athletes' aggressive analysis

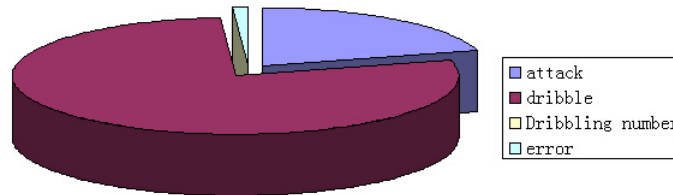|	Attack	Dribble	Dribbling number	Error
Total number	2156	8236	3.8	109
Average	179.5	686.3	--	9.1

Figure 8 : The young female athletes' aggressive analysis in our country

Above statistical Figure and pie chart find that in Chinese women's basketball, number of situ catch and get rid of and catch accounts for 70%,which makes preparation for Chinese goal and scoring, and meanwhile total number of dribbling is higher that accounts for around 80%.

OPTIMAL SOLUTION MODEL-BASED PHYSICAL EXERCISES TO MENTAL HEALTH INFLUENCE STUDY
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Guiding thought of goal programming

Goal programming's objective function general fundamental form is:

(1) Positive and negative deviation variable tries to be small so that just arrives at goal value:

$$\min z = f(d^+ + d^-)$$

(2) Positive deviation tries to get small, it doesn't need to arrive at goal value

$$\min z = f(d^+)$$

(3) Negative deviation tries to get small, above goal value and surplus amount is not limited

$$\min z = f(d^-)$$

Priority factor: $P_1, P_2, \cdots$, and it has $P_k >> P_{k+1}, k = 1,1,\cdots,q$, represents that P_k has bigger priority than P_{k+1}.
Goal programming general mathematical model:

$$\min z = \sum_{k=1}^{q} P_k \left(\sum_{j=1}^{l} \omega^-_{kj} d^-_j + \omega^+_{kj} d^+_j \right)$$

$$\begin{cases} \sum_{j=1}^{n} a_{ij}x_j \le (=,\ge)b_i, i=1,\cdots,m \\ \sum_{j=1}^{n} c_{ij}x_j + d_i^- - d_i^+ = g_i, i=1,\cdots,l \\ x_j \ge 0, j=1,2,\cdots,n \\ d_i^-, d_i^+ \ge 0, i=1,2,\cdots,l \end{cases}$$

Goal programming data handling

According to above goal programming guiding thought, carry out data processing with Chinese young women's basketball data table, its main procedures are as following:

For $k=1,2\cdots,q$, it solves

$$\min z = \sum_{j=1}^{l} P_k \left(\sum_{j=1}^{l} \omega^-_{kj} d_j^- + \omega^+_{kj} d_j^+ \right) \tag{1}$$

$$\sum_{j=1}^{n} a_{ij}x_j \le (=,\ge)b_i, i=1,\cdots,m \tag{2}$$

$$\sum_{j=1}^{n} c_{ij}x_j + d_i^- - d_i^+ = g_i, i=1,\cdots,l \tag{3}$$

$$\sum_{j=1}^{l} \left(\omega^-_{sj} d_j^- + \omega^+_{sj} d_j^+ \right) \le z_s^*, s=1,2,\cdots,k-1 \tag{4}$$

$$x_j \ge 0, j=1,2,\cdots,n \tag{5}$$

$$d_i^-, d_i^+ \ge 0, i=1,2,\cdots,l \tag{6}$$

Among them, Optimal value is z_k^*

At first, the most important is speed status, so its priority rank the first grade P_1; Secondly, psychological quality is the second grade P_2; physical quality is the third grade P_3; Finally, reaction capacity is the fourth grade P_4. Thereupon it gets corresponding goal programming model:

$$\min z = P_1 d_1^- + P_2 (d_2^+ + d_2^-) + P_3 (3d_3^+ + 3d_3^- + d_4^+) + P_4 (3d_4^+ + 3d_4^- + d_5^+)$$

$$65.22x_1 + 20.98x_2 + 11.54x_3 + 2.26x_4 = 1.5$$

$$59.13x_1 + 23.63x_2 + 14.19x_3 + 3.05x_4 = 0.75$$

$$58.12x_1 + 23.97x_2 + 14.58x_3 + 3.33x_4 = 0.5$$

$$x_1, x_2, \cdots, x_i, d_i^+, d_i^- \ge 0, i=1,2,\cdots,4$$

By MATLAB software calculating above objective functions, and further get goal programming optimal solution is: $z^* = (1,2,3)$, and athlete speed percentage is 79.7%.

Result analysis

From above objective function optimal solution, it can get conclusions that improve women's basketball young athletes speed is the upmost way to improve athletes' comprehensive strength, secondly, athletes' physical quality is the guarantee to ensure athletes to maintain in good condition in whole match.

DISCRIMINANT ANALYSIS METHOD-BASED PHYSICAL EXERCISE CRITERION THAT FACILITATES MENTAL HEALTH DEVELOPMENT

Establish discriminant analysis model

Under the above discriminant criterions, established classification functions forms are:

$$\begin{cases} y_1 = c_{01} + c_{11}x_1 + c_{21}x_2 + c_{31}x_3 + \cdots + c_{p1}x_p \\ y_2 = c_{02} + c_{12}x_1 + c_{22}x_2 + c_{32}x_3 + \cdots + c_{p2}x_p \\ y_3 = c_{03} + c_{13}x_1 + c_{23}x_2 + c_{33}x_3 + \cdots + c_{p3}x_p \\ \cdots \\ y_n = c_{0n} + c_{1n}x_1 + c_{2n}x_2 + c_{3n}x_3 + \cdots + c_{pn}x_p \end{cases}$$

According to above data, process with data, and establish Bayes discriminant analysis classification functions' equation set so that determines physical exercises time criterion that is beneficial to mental health development.

Establish Bayes discriminant analysis classification function
Processing data

Utilize SPSS software to analyze TABLE 1 data, and then it can get following classification function regarding physical exercises time and mental health status:

TABLE 10 : Coefficients table

Model	Non-standardized coefficients		Standardized coefficients	t	Sig.
	B	Standard error	Trial version		
(Constant)	3.659	1.334		2.742	.223
Health	.315	.325	1.817	.998	.685
Insufficient endurance	.390	.423	1.954	.923	.525
Insufficient speed	-1.161	.929	-2.949	-1.249	.430
Insufficient strength	1.374	1.439	.954	.793	.456

According to above coefficient TABLE 10, it can get physical exercises time criterion's classification function that is beneficial to mental health development:

$$y = 0.998x_1 + 0.923x_2 - 1.249x_3 + 893x_4 + 2.742$$

Among them, y is physical exercises time, x_1 is health, x_2 is insufficient endurance, x_3 is insufficient speed, x_4 is insufficient strength.

Improved discriminant analysis classification function

In order to improve discrimination accuracy, it makes improvement on above Bayes discriminant analysis classification functions' equation set. Bayes discriminant analysis classification function is converted into following form:

$$\begin{cases} y_1 = c_{01} + c_{11}x_1 + c_{21}x_2 + c_{31}x_3 + \cdots + c_{p1}x_p + \ln(q(y_1)) \\ y_2 = c_{02} + c_{12}x_1 + c_{22}x_2 + c_{32}x_3 + \cdots + c_{p2}x_p + \ln(q(y_2)) \\ y_3 = c_{03} + c_{13}x_1 + c_{23}x_2 + c_{33}x_3 + \cdots + c_{p3}x_p + \ln(q(y_3)) \\ \cdots \\ y_n = c_{0n} + c_{1n}x_1 + c_{2n}x_2 + c_{3n}x_3 + \cdots + c_{pn}x_p + \ln(q(y_n)) \end{cases}$$

During researching on physical exercises time and mental health, $q(y) = 0.55$。

And then it can get:

$$y = 0.998x_1 + 0.923x_2 - 1.249x_3 + 893x_4 + 2.742 + \ln(0.55)$$

That is:

$$y = 0.998x_1 + 0.923x_2 - 1.249x_3 + 893x_4 + 2.144$$

Above is discriminant function that is beneficial to Chinese women's basketball young athletes' comprehensive quality criterion.

Define classification criterion

According to goal programming conclusion, and make analysis of comprehensive strength and scoring status correlation, now it defines above criterion is the criterion to define comprehensive strength through physical exercises time. By above

Criterion analysis, it gets that women's basketball young athletes' comprehensive strength improvement is closely related to players speed, endurance and physical quality at ordinary times, so that makes preparation for Chinese women's basketball young athletes training.

CONCLUSION

(1) Firstly, the paper makes classification of investigated scholars, it gets that among investigation, associate professors account for around 46%, it increase persuasiveness of the paper; and analyzes women's basketball players' movement status, it finds that Chinese women basketball players' centers movement is more frequent, which builds foundation for Chinese women's basketball attacking.

(2) Secondly, it analyzes Chinese women's basketball attack and rebounds acquiring status, and gets that Chinese women basketball young athletes speed and scrambling abilities are relative weaker than other teams, and the field of cooperation among members are to be further improved, which provides orientation for China's training on women's basketball young athletes.

(3) Finally, the paper utilizes SPSS software to make quantitative analysis of the two correlations. On this basis, it utilizes goal programming method to analyze Chinese women basketball players' comprehensive strength status, and gets optimal solution that is beneficial to Chinese women's basketball development, and further get conclusion that in women's basketball training, it should intensify training on athletes' speed and endurance, only then can provide guarantee for Chinese athletes giving their normal levels into play in the field.

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