



Research Article

ISSN : 0975-7384
CODEN(USA) : JCPRC5

Research of badminton forehand smash technology based on biomechanical analysis

Yang Yang

School of Politic Science and Public Management, Southwest University, Beibei, Chongqing, China

ABSTRACT

Rural sports is one of important part in Chinese sports, it affects Chinese sports overall development at every turn. In current stage, Chinese rural sports have many problems, insufficient investment, and imperfect structure, non-deepen sports awareness and others are factors restrict its development, so research on rural sports optimization countermeasures has become presently Chinese rural sports development priority. The paper utilizes comparative analysis and goal programming method to make comprehensive analysis of Chinese rural sports. Firstly make comparative analysis of Chinese rural sports and urban sports, study on urban and rural sports differences from urban residents sports fitness awareness, sports fitness education receiving path, as well as sports activity organizations three aspects, and analyze urban and rural residents satisfaction degree on sports activity, and further find that rural sports develop slower with respect to urban sports, urban and rural sports development has larger differences. Secondly, on this basis, utilize goal programming to make quantitative research on best sports activities fit for Chinese rural sports development, by establishing objective functions, calculate optimal solution, and further get that badminton, social dance and square dance are best items that fit for Chinese rural sports development, and rural residents satisfaction degree on them is higher.

Key words: Rural sports, comparative analysis method, goal programming method, optimal solution, sports fitness

INTRODUCTION

In present stage, no matter from sports population, mass participation in sports conditions, or Chinese sports performance in world level competitions, Chinese sports have been greatly transformed. However, in the background of Chinese sports rapid development, it still has many problems, and has lots of Chinese sports development constraint factors. Among them, rural sports are one of main factors [1-4]. For years, scholars have made many research on rural sports, and got conclusion.

Li Fei took Wanjiang as an example to interview and investigate, as well as release questionnaire, he got reality report about university students village officials sports behaviors, reviewed rural sports development from university students' sports behaviors, and pointed out that university students village officials series of measures about rural sports generated larger impacts on Chinese rural sports, their measures were implemented into rural masses life, which was firm and reliable and propelled Chinese rural sports sustainable development; When researched on rural sports development, Liu Jian-Min took Hebei province as an example, by consulting lots of documents, summarizing predecessors experiences, utilizing logistic analysis, mathematical statistics, system analysis and other methods, as well as combining with Hebei province present development status, he proposed rural sports development process existing issues and corresponding countermeasures [5-8]; Yu Ying-Mao utilized documents, system analysis and other methods, made quantitative analysis of rural physical education status, analyzed its development process problems by data statistical charts, pointed out rural physical education suffered economic development, rural resident sports awareness and others influences, its development was relative slow, and combined with present stage rural sports and Chinese rural development overall status, provided corresponding

countermeasures [9-12]; Lan Guo-Bin researched on urban and rural sports development process existing problems and gap by comparing urban and rural sports development status, he pointed out that Chinese urban and rural sports suffered multiple factors affects and showed imbalanced development, urban and rural sports development gap was larger, especially rural sports development war relative backward, to better propel to Chinese sports development, it should encourage urban sports to drive rural sports development, so that let urban and rural sports to coordinate develop [10].

The paper utilized mathematics comparative analysis method and goal programming method, establishes mathematical model about Chinese rural sports development optimization countermeasures. Firstly, utilize comparative analysis; make comprehensive analysis of urban sports and rural sports status. By analyzing urban and rural residents satisfaction degrees on sports activities, specific study on urban and rural residents gaps in sports fitness awareness, sports fitness education receiving path, and sports activities organizations three aspects, and further get conclusion that rural sports develop slower, urban and rural sports development has larger differences. Secondly, on this basis, combine with goal programming method quantitative researches' Chinese rural sports activities forms and villagers satisfaction degrees, it further points out that best sports activities that fit for Chinese rural sports development are mainly badminton, social dance and square dance, and mass satisfaction degrees are higher on them, to propel to Chinese sports sustainable development, it should advocate urban and rural sports coordinate development on the basis of developing rural sports.

RURAL SPORTS EVALUATION MODEL ESTABLISHMENT

Rural development affects Chinese sports overall development. In present stage, no matter from sports population, mass participation in sports conditions, or Chinese sports performance in world level competitions, Chinese sports have been greatly transformed. But Chinese rural sports have many problems, insufficient fund, and organizational structure is not sound, non-deepen sports awareness and others, so it is necessary to study on rural sports optimization countermeasures.

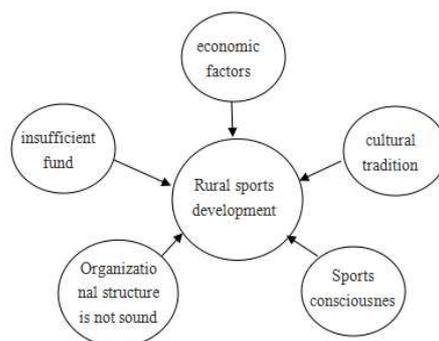


Figure 1: Rural sports development factors

From above Figure 1, it is clear that Chinese rural sports development constraint factors are mainly economic development, cultural tradition, sports awareness, sports facility construction, government sports investment and so on. To comprehensive develop Chinese rural sports, shorten urban and rural sports development gap, it is necessary to improve rural residents' sports awareness, increase government sports investment, and encourage sports clubs, sports associations' development so as to expand sports activities impacts on masses life.

Chinese rural sports satisfaction degree investigation

Sports facilities construction status is the basis of sports developing in city and village; good sports facilities have better promotions to residents' physical exercises. Compare Chinese urban and rural residents satisfaction degrees on sports facilities demands, is helpful for us analyzing targeted status, find out sports urban and rural development gap, and point out existing problems, and further better promote sports rural development [13].

Table 1: Urban and rural residents' sports facilities satisfaction degree

Item	City	Country	Difference
Satisfied	10%	4%	6%
Basic satisfied	40%	16%	24%
Dissatisfied	45%	61%	-16%
Does not matter	5%	19%	-14%

Above Table 1 is Chinese urban and rural residents sports facilities' satisfaction degree investigation comparison data, it is from Chinese statistics yearbook, general administration of sport of China and internet relative

investigation report. Draw above data into following statistic Figure 2, and further analyze data presented features:

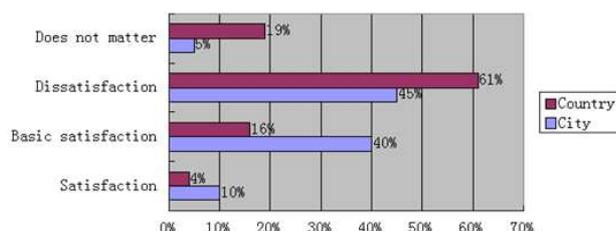


Figure 2: Urban and rural resident's sports facilities satisfaction

From above statistical Figure2, it can analyze and get: on a whole, with respect to rural residents, Chinese urban residents have higher satisfaction degrees on sports facilities, but only 10% is satisfied with sports facilities, 40% is basic satisfied, and 45% residents are dissatisfied; rural residents satisfaction degree on sports facilities is inferior to urban residents, nearly 61% residents are dissatisfied with sports facilities, only 4% is satisfied, 16% is basic satisfied, which has larger differences with urban residents satisfaction degree.

Thereupon, Chinese sports facilities construction is not so optimistic in city and country, most of residents are dissatisfied, especially for rural sports facilities construction. Causes that form into such situation is mainly affected by rural economic development, government investment on sports facilities are not enough, sports facilities construction in country are still not complete, and further lead to rural resident dissatisfaction with sports facilities. In addition, urban and rural big gap's historical issue is also key factor to restrict urban and rural sports development, to further promote urban and rural sports development, shorten urban and rural gap is main way.

Chinese rural sports awareness

Sports development not only suffers economic factor, region factor, infrastructure construction and other factors influences, sports awareness is also key factor that affects its development. Sports not only is a competition that is popular on TV, is also massive activity of mass recreational entertainment, body building. Research urban and rural sports fitness awareness differences is helpful for us finding out problems, and targeted problems, combining with urban and rural development status to put forward corresponding conclusion and countermeasures [14].

Table 2: Chinese urban and rural residents' sports fitness investigation

Item	Manual work instead of physical fitness	No disease or health	Physical fitness is equal to the waste of time	Fitness to promote physical and mental health
City	2%	5%	3%	90%
Country	12%	47%	21%	20%
Difference	-25%	-42%	-18%	70%

Above Table 2 is Chinese urban and rural residents' sports fitness consciousness investigation comparison data, is from Chinese statistics yearbook, general administration of sport of China and internet relative investigation report. Draw above data into following statistic Figure 3, and further analyze Chinese urban and rural residents sports consciousness presented features.

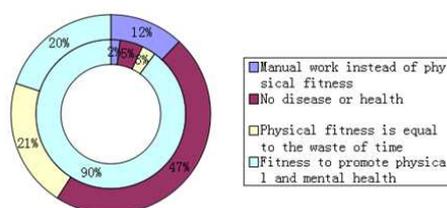


Figure 3: The sport consciousness of urban and rural residents

From above ring Figure3, it is clear that Chinese urban residents sports fitness consciousness is stronger, almost all think sports fitness can promote physical and mental health, only little people recognition on sports fitness is incomplete that thinks manual work can replace physical fitness, only no diseases it means health, and physical fitness is equal to the waste of time. By comparing, the cases are more serious in country, though 70% rural residents think physical fitness affects physical and mental health, nearly half people think physical fitness is useless that equal to the waste of time. Such situation affects sports promotion in national range to great extent, especially affects

rural sports development.

Chinese rural sports fitness situation

Sports development in city and country, especially rural development is affected by sports fitness education to great extent. With respect to country, urban residents receiving sports fitness education paths are various, network, library, clubs, friends, colleagues and so on, and obtain sports fitness education by network, library, clubs and other ways are relative wide. While country suffers economic development, high technological information transmission, traditional thoughts influences, receiving sports fitness education is not going well, and is relative poor with respect to city.

Below Table 3 is Chinese urban and rural sports education receiving paths investigation report, data is from Chinese statistics yearbook, general administration of sport of China and internet relative investigation report.

Table 3: Urban and rural residents' sports fitness education receiving paths (multiple choices)

Item	City	Country	Difference
The network, the library	43%	11%	32%
Associations and clubs	47%	7%	40%
Experts, social instructors	33%	13%	20%
Friends, colleagues	67%	63%	4%

Draw above data into following statistical Figure 4, and further analyze conclusion:

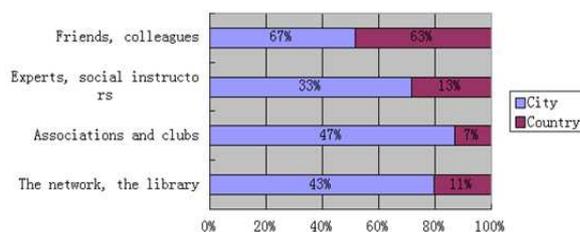


Figure 4: The way to get the fitness education of urban and rural residents

Above statistical Figure 4 indicates no matter get sports fitness education from network, library, associations and clubs, or by friends, colleagues and others transmission and introduction, urban sports fitness developing is better than rural. To urban residents, get sports fitness knowledge by friends, colleagues introducing is the most important path, secondly is getting through network, library, associations and clubs.

Friends and colleagues impacts are relative important, which is more obvious reflecting in country, nearly 63% population gets sports fitness knowledge by friends and colleagues, it is clear that people have certain impacts on sports fitness information transmission, if it wants to further propel to sports fitness development in China, it should strengthen its publicity in massive life, and positive propel to network, clubs and others advertising on sports fitness.

Chinese rural sports activities times

When mass can positive participate in sports activity, on one hand, it also suffers organizer influences. In general, sports fitness organizational activities are organized by government sector organizations, association of social organizations and social sponsorship. According to Chinese sports status, association of social organizations sports activity organizing times are more, which mainly because most association of social organizations members have certain understanding on physical fitness, together with people love physical fitness so that let people to have higher positivity when participate in sports activity, no matter activity times or activity participants amount, obtained results are better than other organizations.

Table 4: Urban and rural sports activity organizational ways comparison

Item	The government sector organizations	Association of social organizations	Social sponsorship
City	23.98%	41.22%	34.8%
Country	33.33%	46.08%	20.62%
Ratio	0.72	0.89	1.69

Above Table 4 is Chinese urban and rural sports activity organizational ways comparison, data is from Chinese statistics yearbook, general administration of sport of China and internet relative investigation report. For above data, it makes statistical analysis, and respectively draw pie chart about city sports activity organizational way and rural

sports activity organizational way, so that better compare urban and rural sports activity organization aspect gaps.

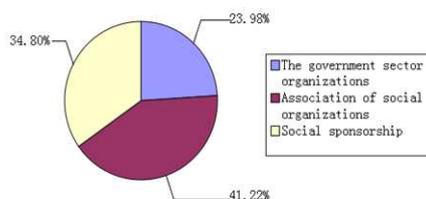


Figure 5: City sports organization

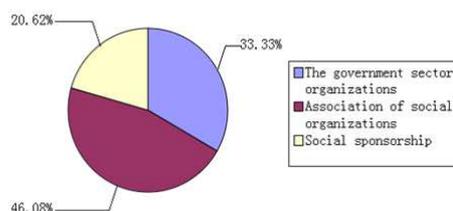


Figure 6: Country sports organization

From above pie-shaped Figure 5-6 analysis, it gets conclusion that Chinese sports activity organizations are better developing in the country, especially for government sector organizations and association of social organizations. With respect to city, when city organizes sports activities, it is based on association of social organizations, government sector organizations are little. Overview urban and rural sports organization ways, association of social organizations are main organization way, to better propel to sports activity development in Chinese broad people, it should positive encourage sports type association of social organizations development, propel to association of social organizations sports activities, so that build good basis for sports activity further developing in masses.

GOAL PROGRAMMING-BASED CHINESE RURAL SPORTS ACTIVITY ITEM RESEARCH

Sport is one of Chinese masses recreational entertainment important choices, with sports development and national fitness widely spreading in China, physical fitness has already become main part in Chinese public fitness. However, on a whole, Chinese physical fitness ways are relative simple that is practicability based, generally non-operating sports venues are well received, and operating way is self-management.

According to investigation, Chinese public sports fitness contents are mainly badminton, swimming, football, basketball, volleyball, gymnastics, climbing, dance, billiards, bowling, rope skipping and so on. Following Table 5 is Chinese rural sports main items, data is from general administration of sport of China and Chinese statistics yearbook data.

Table 5: Goal programming data investigation table

	Football	Basketball	Badminton	Taijiquan	Social dance	Square dance	Others
Percentage	5.7%	3.2%	26.4%	11.5%	21.4%	28.1%	3.6%
Satisfaction degree	7.8%	5.4%	25.1%	15.6%	19.7%	23.9%	2.5%

Goal programming guiding thought

As the name implies, goal programming is programming given system problems by mathematical methods, so that getting a group optimal scheme of actual expected targets. Goal programming overcomes linear programming limitations, which can only solve a group of linear constraint conditions. In addition, in reality life, to certain targets, it has primary and secondary, and also supplement and independent from each other. And meanwhile it also exists maximum value, minimum value, and the difference of quantization and qualitative, LP cannot solve these problems, while goal programming just overcomes the shortcomings.

In general, goal programming has three methods, weighted coefficient method, priority ranking method and efficient solution method. Among them, weighted coefficient method is to define a weight on every required goal, so that transform complex multiple goal problems into single goal problem, but its weights rationality cannot well grasped; priority ranking method is to classify each goal into different grades, its classification evidence is each goal emphasis degree. Efficient solution method can take account of every goal so that get most satisfied solution.

Goal programming objective function is composed by positive and negative deviation variables according to each goal constraints and endowed corresponding prior factors. Its general basic forms are:

Positive and negative deviation variable tries to be small so that just arrives at goal value: $\min z = f(d^+ + d^-)$

Positive deviation tries to get small, it doesn't need to arrive at goal value: $\min z = f(d^+)$

Negative deviation tries to get small, above goal value and surplus amount is not limited: $\min z = f(d^-)$

Among them, positive and negative deviation variables definitions are as following:

Known that d is function of decision-making variable, positive deviation variable $d^+ = \max\{d - d_0, 0\}$ represents the part that decision value surpasses goal value, negative deviation variable $d^- = -\min\{d - d_0, 0\}$ represents the part that decision value hasn't arrived at goal value, and d_0 is d goal value, it always has $d^+ \times d^- = 0$.

Priority factor: P_1, P_2, \dots , and it has $P_k \gg P_{k+1}, k = 1, 1, \dots, q$, represents that P_k has bigger priority than P_{k+1} .

Goal programming general mathematical model:

Known $x_j (j=1, 2, \dots, n)$ is goal programming decision-making variable, it totally has m pieces of constraints are rigid constraints, equality constraints, or inequality constraints. There are l pieces of gentle goal constraints, their goal programming constraints deviations are $d^+, d^- (i=1, 2, \dots, l)$. Set there are q pieces of priority ranks that are respectively $P_1, P_2, P_3, \dots, P_q$. In the same priority P_k , there are different weights respectively are ω_{kj}^+ ,

$\omega_{kj}^- (j=1, 2, \dots, l)$. Therefore goal programming general mathematical expression is :

$$\min z = \sum_{k=1}^q P_k \left(\sum_{j=1}^l \omega_{kj}^- d_j^- + \omega_{kj}^+ d_j^+ \right)$$

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

Goal programming data handling

According to above goal programming guiding thought, carry out data processing with rural sports activity contents and villagers' satisfaction degree data, here adopts sequential algorithm. Sequential algorithm is transforming complex goal programming problems into multiple single goal programming problems according to priorities order; its main process is as following:

For $k = 1, 2, \dots, q$, solve:

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

$$\sum_{j=1}^n a_{ij} x_j \leq (=, \geq) b_i, i = 1, \dots, m \quad (2)$$

$$\sum_{j=1}^n c_{ij} x_j + d_i^- - d_i^+ = g_i, i = 1, \dots, l \quad (3)$$

$$\sum_{j=1}^l (\omega_{sj}^- d_j^- + \omega_{sj}^+ d_j^+) \leq z_s^*, s = 1, 2, \dots, k-1 \quad (4)$$

$$x_j \geq 0, j = 1, 2, \dots, n \quad (5)$$

$$d_i^-, d_i^+ \geq 0, i = 1, 2, \dots, l \quad (6)$$

Among them, Optimal value is z_k^* .

Firstly, most important is rural residents satisfaction degree, so its priority rank the first grade P_1 ; Secondly, rural sports activity development suffers economic factor influence that is the second grade P_2 ; Finally, its development status will also suffer rural residents sports consciousness high-low that is the third grade P_3 . Require that resident's satisfaction degree to be above 15%. Thereupon it gets corresponding goal programming model:

$$\begin{aligned} \min z &= P_1 d_1^- + P_2 (d_2^+ + d_2^-) + P_3 (3d_3^+ + 3d_3^- + d_4^+) \\ &5.7x_1 + 3.2x_2 + 26.4x_3 + 11.5x_4 + 21.4x_5 + 28.1x_6 + 3.6x_7 \\ &7.8x_1 + 5.4x_2 + 25.1x_3 + 15.6x_4 + 19.7x_5 + 23.9x_6 + 2.5x_7 = 20 \\ &x_1, x_2, \dots, x_i, d_i^+, d_i^- \geq 0, i = 1, 2, \dots, 7 \end{aligned}$$

By MATLAB software calculating above objective functions, and further get goal programming optimal solution is: $z^* = (3, 5, 6)$, and resident satisfaction degree is 21.2%.

Result analysis

From above objective functions optimal solution, it can get conclusion: badminton, social dance and square dance is the best choice to propel to Chinese rural sports further development and encourage rural people to participate in sports, and rural residents have general higher satisfaction degrees on the three sports activities. Analyze from the perspective of field, the three sports activities equipment, field construction and others are very simple, no so strict requirements, and fit for massive activity, activity venues can easily select. And meanwhile, technical requirement is not too high; it has also larger effects on mass physical and mental influences that conform to masses of each age stage.

CONCLUSION

Utilize comparative analysis method, make comparative analysis of Chinese rural sports and urban sports; it mainly studies on urban and rural residents' satisfaction degrees on sports activities, sports fitness awareness, residents' sports fitness education receiving paths as well as urban and rural organizing sports activity times. By comparative analysis, it finds that urban and rural sports development has larger gap, rural sports development is lower with respect to urban sports, no matter residents' sports fitness awareness, sports education receiving paths, or sports activity organizing times, it is inferior to urban sports, which can be got from residents satisfaction degree on sports activity.

Utilize goal programming method to analyze Chinese rural sports some main activity forms and corresponding masses satisfaction degrees, it gets best sports activities that fit for Chinese rural residents are badminton, social dance and square dance, which have highest mass satisfaction degree and is optimal solution of goal programming. It also proves that in case residents' satisfaction degree is met, badminton, social dance and square dance are events that best fit for Chinese rural sports development, it should encourage rural residents to participate in the three activities.

REFERENCES

- [1] XIAO Huan-yu, WENG Zhi-qiang, CHEN Yu-zhong. *Journal of Shanghai Physical Education Institute*, **2005**, 29(2), 10-14.
- [2] XIAO Huan-yu, FANG Li. *Sports Science Research*, **2005**, 26(1), 7-10.
- [3] MIAO Zhi-wen, QIN Chun-lin. *Journal of Physical Education*, **2006**, 13(1), 119-121.
- [4] YAN De-yi. *Journal of Wuhan Institute of Physical Education*, **2006**, 40(1), 15-19.
- [5] GUO Hong. *China Sport Science and Technology*, **2007**, 43(3), 36-40
- [6] LI Hong, XUE Hai-hong, FENG Wu-long. *Journal of Xi'an Institute of Physical Education*, **2007**, 24(4), 25-28..
- [7] CHEN Po, QIN Zhong-Mei, YIN Ying, XIA Chong-De. *Journal of Beijing Sport University*, **2007**, 30(12), 1610-1613.
- [8] XUE Jin-xia, WANG Jing-tong. *Bulletin of Sport Science & Technology*, **2011**, 19(4), 57-59.
- [9] LI Lin, YANG Jie, YANG Tian, XU Lie-hui. *Journal of Beijing Sport University*, **2010**, (9).
- [10] Zhang B.; Zhang S.; Lu G.. *Journal of Chemical and Pharmaceutical Research*, **2013**, 5(9), 256-262.

- [11] Zhang B.; *International Journal of Applied Mathematics and Statistics*, **2013**, 44(14), 422-430.
- [12] Zhang B.; Yue H.. *International Journal of Applied Mathematics and Statistics*, **2013**, 40(10), 469-476.
- [13] Zhang B.; Feng Y.. *International Journal of Applied Mathematics and Statistics*, **2013**, 40(10), 136-143.
- [14] Bing Zhang. *Journal of Chemical and Pharmaceutical Research*, **2014**, 5(2), 649-659.