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Based on goal programming method of Chinese rural sports optimization countermeasures research

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ABSTRACT

Rural sports as an important part of Chinese sports, moment affects the overall development of China's sports. At present, China's rural sports there are many problems, lack of investment, the structure is not sound, sports consciousness is not thorough and so on are the factors restricting its development, thus the study of rural sports optimization countermeasures is the key of the development of China's rural sports. In this paper, using the comparative method and goal programming method made a comprehensive analysis of the rural sports in China. First Chinese rural sports and city were analyzed, from the urban and rural residents in the sports fitness awareness, by way of fitness education, as well as the three aspects of the organization of the sports activities, the study of the gap between urban and rural sports and analysis of urban and rural residents satisfaction for sports activities, to discover: rural sports relative to the urban sports development is slow, there is a larger gap between urban and rural sports development. Secondly, on this basis, quantitative research by using the goal programming is most suited to China's rural sports development of sports activities, through the establishment of objective function, calculated the optimal solution, further concluded: badminton, ballroom and square dance is the most suitable for China's rural sports development projects, and rural residents on their satisfaction is higher.

KEYWORDS

Rural sports; Comparative analysis method; Goal programming method; Optimal solution; Sports fitness.



INTRODUCTION

At present, both in terms of sports population, the masses participate in sports, or the performance of the Chinese sports in the international competition, Chinese sports have had the very big change. However, in China's sports under the background of rapid development, still exist many problems, there are many factors restricting the development of Chinese sports. Among them, the rural sports is one of the main factors. Over the years, scholars have been to a lot of rural sports research, and the conclusion.

Li Fei to wan jiang city as an example, through investigation, questionnaires, get about the sports behavior of college student village official's report, from the university student village official sports behavior of rural sports development, and put forward a series of measures of college student village official in view of the countryside sports has a great influence on China's rural sports, the measures to implement the rural masses life, solid and reliable, and promote the sustainable development of China's rural sports; Jian-min liu in the research on the development of rural sports in hebei province as an example, through consulting a large number of literature, a summary of the experience of our predecessors' studies, using the methods of logical analysis, mathematical statistics, system analysis, combined with the current development status in hebei province, puts forward the rural sports in problems existing in the process of development, as well as the corresponding countermeasures; Yu Yingmao by using the methods of documentary, system analysis, quantitative analysis on the current situation of rural sports education, through data statistical figure analyses the problems in the development process, points out that the rural physical education by economic development, the influence of the rural residents' sports consciousness and so on, development is relatively slow, and combined with the overall current situation of development of rural sports and rural China at the present stage, gives corresponding countermeasures; His blue countries by comparing the urban and rural sports development present situation, to research the problems in the development process of urban and rural sports and gap, puts forward China's urban and rural sports influenced by multiple factors, the uneven development of the sports development gap between rural and urban areas is larger, especially the rural sports development is relatively backward, to better promote the development of China's sports undertakings, urban sports should be encouraged to promote rural sports development, so that the coordinated development of urban and rural sports.

Compared in this paper, by using mathematical analysis method and the goal programming method, to establish the mathematical model of optimization countermeasures about China's rural sports development. First of all, using comparative analysis, comprehensive analysis of urban and rural sports status quo. Through the analysis of urban and rural residents satisfaction for sports activities, specific studies the urban and rural residents in sports fitness consciousness, the sports fitness education approach, and the gap between three aspects of the organization of the sports activities, so as to draw the conclusion: the rural sports development is slow, there is a larger gap between urban and rural sports development. Secondly, on this basis, the combination of goal programming method the quantitative study of Chinese rural sports activities form and the villagers satisfaction, thus put forward the most suitable for the development of Chinese rural sports sports activities mainly badminton, dancing and square dance, and public satisfaction is higher, in order to promote the sustainable development of sports undertakings in China, should be based on the development of rural sports, promote the coordinated development of urban and rural sports.

RURAL SPORTS EVALUATION MODEL ESTABLISHMENT

Rural development affects the whole development of Chinese sports. At present, both in terms of sports population, the masses participate in sports, or the performance of the Chinese sports in the international competition, Chinese sports have had the very big change. But sports there are many problems in rural China, insufficient funds, the organizational structure is not sound, sports

consciousness is not thorough, etc., thus it is necessary to optimize rural sports countermeasures were studied.

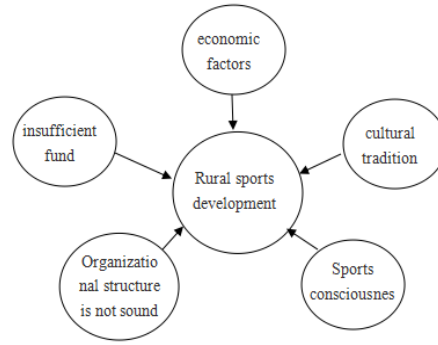


Figure 1 : Rural sports development factors

Can be seen from Figure 1: what are the major factors restricting the development of China's rural sports economic development, cultural tradition, sports consciousness, sports facilities, the government sports investment, etc. For the comprehensive development of China's rural sports, shorten the gap between urban and rural sports development, it is necessary to improve rural residents' sports consciousness, sports investment from the government, encouraging the development of the sports club, sports association, to expand the sports activities in the life influence.

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:

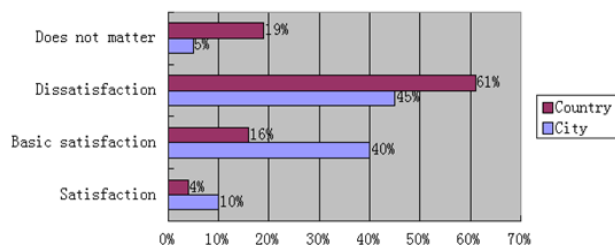


Figure 2 : Urban and rural resident's sports facilities satisfaction

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.

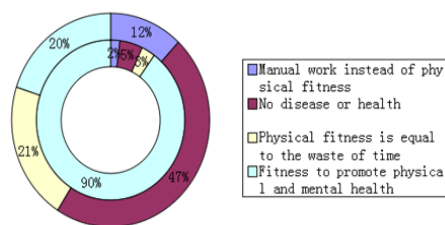


Figure 3 : The sport consciousness of urban and rural residents

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:

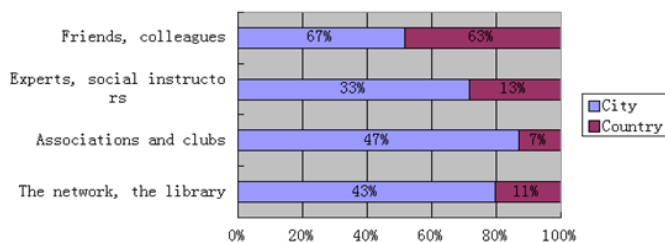


Figure 4 : The way to get the fitness education of urban and rural residents

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.

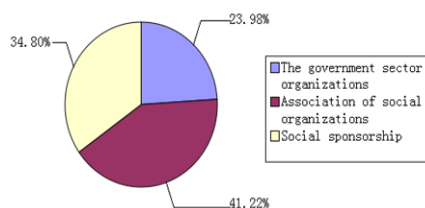


Figure 5 : City sports organization

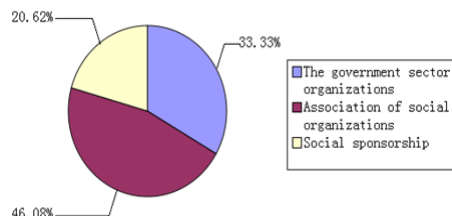


Figure 6 : Country sports organization

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^+ , $d_i^-(i=1,2,\dots,l)$. 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:

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

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

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

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

$$x_j \geq 0, j = 1, 2, \dots, n \tag{5}$$

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

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:

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

$$5.7x_1 + 3.2x_2 + 26.4x_3 + 11.5x_4 + 21.4x_5 + 28.1x_6 + 3.6x_7$$

$$7.8x_1 + 5.4x_2 + 25.1x_3 + 15.6x_4 + 19.7x_5 + 23.9x_6 + 2.5x_7 = 20$$

$$x_1, x_2, \dots, x_i, d_i^+, d_i^- \geq 0, i = 1, 2, \dots, 7$$

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 the objective function of the optimal solution can be concluded that: badminton, ballroom and square dance is to promote the further development of rural sports in China, to encourage the best choice of the rural people to participate in sports, and rural residents of the generally high satisfaction of the three kinds of sports activities. From the perspective of the site of the three sports equipment, site construction and so on all is very simple, not too strict requirements, and is suitable for mass activity, activity place is very good choice. At the same time, the technical requirement is not high, influence on the physical and mental health of the masses is bigger also, accord with people of all ages.

CONCLUSION

The use of comparative analysis, China's rural sports and city, this paper compares and analyzes the main research of urban and rural residents satisfaction for sports activities, sports fitness awareness, residents affected by the sports fitness education approach, and organize sports activities in urban and rural areas. Comparison and analysis, the author found out that there are big gap of urban and rural sports development, rural sports relative to the urban sports development is slow, whether residents' fitness consciousness, sports education ways, or number of sports organizations, are behind the city sports, it can be seen from the satisfaction degree of the residents in sports activities. By using the goal programming of several major activity form of rural sports in China, and the corresponding masses satisfaction was analyzed, and it is concluded that the most suitable for China's rural residents in sports activities: badminton, ballroom and square dance has the highest satisfaction, and the optimal solution of goal programming. It is proved that in the case of meet residents satisfaction, badminton, dancing and square dance is the most suitable for China's rural sports development projects, rural residents should be encouraged to participate in all three activities.

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