Abstract: Community sports fitness as one of important parts in China’s sports, it exerts influences on community’s every resident life and health. In current stage, though China’s community sports activities have some development, they still have problems in development process that need to be timely solved. The paper conducts comprehensive analysis of China’s community sports fitness activities, and combines with numerical analysis method and goal programming to do quantitative research. Firstly, it proceeds with statistical analysis of China’s groups of people that participate in square fitness activities, and carries on research and analysis from the fields of participants’ physical health, social status and others, and analyzes Chinese residents’ satisfaction with different sports activities. Secondly, on this basis, through establishing objective function, utilizing goal programming to establish China’s community sports fitness development optimization model, it analyzes optimization strategies to propel to its development, calculates optimal solution, and further gets that retired people are main people in community fitness activities, square dance and other group activities are important events that most fit for China’s community sports fitness activities development, and Chinese residents have higher satisfaction with such activities, which have bigger impacts on China’s community activities development.

Keywords: Community square fitness, goal programming, optimization strategies.

1. INTRODUCTION

In contemporary society, masses are best carriers for sports communication, and also the most powerful strength to develop sports. Masses positive participate in community square dances fitness situation that let today’s community square fitness has already gained greatly development. However, in the background of Chinese nationwide fitness, it still has lots of problems and many factors that restrict China’s community activities development. Among them, which exercise should be chosen by community fitness is one of the main factors [1].

Lu Chen in “Survey on square fitness dance development situation in community sports”, he took Jishou city as an example, conducted interviewing and investigation, released questionnaire, obtained actual reports on square fitness, saw community activities development from community square dance behaviors, and put forward a series of measures regarding improving community activities that exerted larger influences on China’s community activities, the measures effectiveness was significant in its implementation in mass life [2]. Wang Shao-Jiu in the article “Square fitness activities functions on coronary heart disease patients’ emotions and autonomic nerve”, he carried out sample survey on lots of patients that suffered coronary heart disease, by consulting lots of documents literature, summarizing formers’ research experiences, utilizing logical analysis, mathematical statistics, system analysis and other methods.
research, learns different square community activities, different cities, different groups of people most suitable activities or fitness equipments for the group health, only then can let square activities to give their maximum functions into play and achieve the purpose of serving to people.

2. COMMUNITY SQUARE FITNESS CURRENT SITUATION

Community square activities development has an impact on China’s national quality healthy development. In current stage, no matter from exercises quantity, exercises ways, or China’s urban and rural community sports investment representation, all have great changes. But China’s community activities still have many problems, unbalanced investment, imperfect organizational structure, not deeper consciousness and others, so it is necessary to do optimization research on community activities [6] (Fig. 1).

![Fig. (1). The influence of community activities.](image)

From above Fig. (1), it is clear that factors affect China’s community square development are mainly sports gear and equipment, groups, urban and rural differences, state investment and so on. To develop community sports in all-round way and shorten urban and rural sports development differences, it is necessary to improve residents’ sports awareness, increase government investment in public sports equipment and advertising media propaganda in community sports field so that expand their impacts on masses.

2.1. Fitness Participants’ Occupation Status

In contemporary society, people pay more and more attentions to health, participants in community fitness activities have almost covered all the scopes of occupations, comparing with China’s each activity group demands is helpful for us to analyze targeted at current situation, find out weakness in community sports activities, and put forward existing problems and further better propel to China’s community sports activities construction as well as better implement people-oriented policies (Table 1).

![Fig. (2). Professional fitness participants.](image)

Table 1. Fitness participant occupation.

<table>
<thead>
<tr>
<th>Group of people</th>
<th>Retired People</th>
<th>Civil Servants</th>
<th>Scientific Research Personnel</th>
<th>Farmers</th>
<th>Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proportion%</td>
<td>44.54%</td>
<td>11.3%</td>
<td>13.75%</td>
<td>12.04%</td>
<td>10.32%</td>
</tr>
</tbody>
</table>

2.2. Chinese Residents’ Sports Fitness Consciousness

Community activities development not only suffers economic factors, regional factors, infrastructure construction and other factors influences, sports
consciousness also is a key factor that affects its development. Sports not only are just something one tells, but also are massive activities in mass relaxation entertainment and body building. Research on community activities fitness consciousness differences is helpful for us to find out problems and put forward corresponding solutions by combining with urban and rural development situations targeted at the problems (Table 2).

Above Table 2 is China’s community square fitness consciousness survey contrastive data, from which the percentage reflects mass with different sports fitness consciousness proportions in the number of Chinese residents, data is from Chinese statistical yearbook, general administration of sport of China and internet relevant investigation report. Draw above data into following statistical Fig. (3), by comparing, it further analyzes residents’ fitness consciousness reflected features:

<table>
<thead>
<tr>
<th>Thought</th>
<th>Have no Disease or Health</th>
<th>A Waste of Time</th>
<th>Sports Fitness Propels to Physical and Psychological Health</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage(%)</td>
<td>13%</td>
<td>7%</td>
<td>10%</td>
</tr>
</tbody>
</table>

![Fig. (3). The sport consciousness of residents in our country.](image)

Table 3. Chinese community fitness activities participants’ health conditions.

<table>
<thead>
<tr>
<th>Health conditions</th>
<th>Health</th>
<th>Good</th>
<th>General</th>
<th>Weaker</th>
<th>Poor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proportion</td>
<td>35%</td>
<td>33%</td>
<td>28%</td>
<td>2%</td>
<td>2%</td>
</tr>
</tbody>
</table>

2.3. Chinese Community Fitness Activities Participants’ Health Conditions

Sports spread in China, especially for community healthy activities spreading; it is related to every participant specific health condition and his recognition degree on health to a great level. Below Table 3 is Chinese community fitness activities participants’ health conditions investigation table and is investigated through education path, data is from Chinese statistical yearbook, general administration of sport of China and internet relevant investigation report. Make statistical analysis of below statistical Table 3, and further get conclusions:

Draw above data into following statistical Fig. (4), and further analyze conclusions:

![Fig. (4). The health of the community fitness activities in China.](image)

Above statistical Fig. (4) indicates that healthy mass, people with good physique, people with general physique respectively occupy around one third while occupy large proportions in total, with the improvement of living standards, people demands not only restrict in regarding...
happiness and rich by well dressing and delicacies eating, now people pay more attentions to their healthy levels, because a person health is one’s future success foundation, the table quite conforms to contemporary people’s thoughts and features. If it wants to further propel to sports fitness development in China, it should strengthen its publicity among mass life, and positive impel network, clubs and others publicity on sports fitness.

2.4. Chinese Square Activities Different Ways

Whether masses can positive participate in community sports activities fitness, on one hand, it also suffers organization party’s influences. In general, community sports fitness organizational activities, organizational ways, types of activities are diversified, for different people, their interests and habits are different, physical health conditions are different, living social environments are different, so they will select different suitable sports fitness activities to achieve their own healthy demands (Table 4).

Above Table 4 is proportion of China’s square activities different ways, data is from Chinese statistical yearbook, general administration of sport of China and internet relevant investigation reports. For above table data, it carries out statistical analysis, and respectively draws pie charts about city sports activities organizational way and rural sports activities organizational way so that better develops China’s community sports activities fitness work, and lets it to exert an impact on more people.

From above broken line Fig. (5) analysis, it gets conclusions that in China’s community sports fitness activities, community square dance occupies great proportions that is around 40%, and the number of people are to be further improved, which is caused by square dance own unique advantages, square dance is a kind of collective dance, everyone gathers together in this way not only can keep fit through exercising, but also can exchange, because most of families are busy with their works in the day time, they can chat, relieve boredom and divert themselves that propel to good interpersonal relationships, the fewer proportion is in sword dancing because sword dancing technical contents are higher that is not easy to grasp.

2.5. China’s Community Square Fitness Activities Places

Expansion of community sports fitness activities, especially for the expansion of white-collar workers that suffers sports fitness education influences to a great extent. Now various units, communities and schools increase stadiums and sports rooms construction to meet the fitness demands from these group of people, which not only serves to people, but also is China vigorously promoting and advocating and conforms to Chinese contemporary national conditions demands and policies encouragement.

Below Table 5 is China’s community activity place statistical table, it obtains investigation report through physical education path, data is from Chinese statistical yearbook, general administration of sport of China and internet relevant investigation report.

By statistical analysis method, it carries out statistical analysis of above data, draws statistical Fig. (6), and gets relative conclusions about China’s community square fitness activities different ways:

From above bar Fig. (6), it indicates that nearly half residents take fitness activities in park square due to it is public place, where many people with same interests will
gather together to do fitness activities to bring pleasure to their life, while the proportion of one’s own courtyard is relative little, as the amount of population increases, little people can afford to buy houses with courtyards, so it conforms to contemporary people’s consumption level.

3. CHINA’S RURAL SPORTS ACTIVITIES EVENTS

Sport is one of important choices in relaxation entertainment for China’s public, with sports undertaking development and nationwide fitness extensive expansion in China, sports fitness has already become a main part in China’s public. However, from an overall perspective, China’s sports fitness ways are so simple and major in practicability, it is usually the non-operational sports places are popular and operational way is self-management.

According to investigation, China’s public sports fitness contents are mainly sports equipment, taijiquan, sword dancing, square dance, running, gymnastics, bowling, rope skipping and so on. Below Table 6 is China’s community sports activities main events, data is from general administration of sport of China and Chinese statistical yearbook data:

### Table 6. Goal programming data investigation table.

<table>
<thead>
<tr>
<th>Sports equipment</th>
<th>Taijiquan</th>
<th>Sword dancing</th>
<th>Square dancing</th>
<th>Running</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage</td>
<td>28.9%</td>
<td>11.5%</td>
<td>21.4%</td>
<td>30.1%</td>
<td>4.5%</td>
</tr>
<tr>
<td>Satisfaction</td>
<td>26.6%</td>
<td>15.6%</td>
<td>19.7%</td>
<td>28.9%</td>
<td>6.7%</td>
</tr>
</tbody>
</table>

Goal Programming-based Community Square Fitness Activities

Goal programming Guiding Thought

As the name suggests, goal programming is programming all given systematic problems by mathematical methods and further getting a group of optimal schemes of practice expected goal. Goal programming overcomes linear programming constraints that only solve a group of linear constraint conditions. In addition, to certain goals in real life, they should have primary and secondary ones, and also mutual complementation and mutual antagonism. Meanwhile, there is also maximum value, minimum value as well as a difference of quantitative and qualitative, LP cannot solve these problems, while goal programming just overcomes the drawback.

Generally, goal programming has three kinds of methods, weighted coefficient method, priority method and effective solution method. Among them, weighted coefficient method is defining a weight on every solved goal, and further converting complicated multiple goals problems into single goal problems, but its weight rationality is hard to set; priority method is to classify each goal into different grades, its classification evidence is each goal importance. Effective solution can take all goals into account and further get most satisfied solution.

Goal programming objective function is composed of defined corresponding priority factors according to various objective constraints positive and negative deviation values. Its common basic form is:

\[
\min z = f(d^+ + d^-)
\]

Try to make positive deviation small, and then further just arrive at goal value:

\[
\min z = f(d^+)
\]

Try to make positive deviation small, no need to arrive at goal value:

\[
\min z = f(d^-)
\]

Among them, positive and negative deviation values definitions are like following:

\[
\text{known that } d \text{ is decision variable function, positive deviation variable } d^+ = \max \{d - d_0, 0\} \text{ represents the part that calculation value surpasses goal regulated value, negative deviation variable } d^- = -\min \{d - d_0, 0\} \text{ represents the part that calculation value less than goal regulated value, and } d_0 \text{ is } d \text{ goal value, it always has } d^+ \times d^- = 0.
\]

Priority factor: \(P_1, P_2, \ldots, 1\) and it has \(P_i >> P_{i+1}, k = 1, 2, \ldots, q\), which represents \(P_i\) has bigger priority than \(P_{i+1}\).

Goal programming normal mathematical model is:

\[
\text{Known that } x_j (j = 1, 2, \ldots, n) \text{ is decision variable function, it totally has } m \text{ pieces of rigid constraints, equality constraints or inequality constraints. It has } l \text{ pieces of soft goal constraints, its goal programming constraints deviation variable is } d_j^+ (i = 1, 2, \ldots, l). \text{ Assume that it has } q \text{ pieces of priorities that are respectively } P_1, P_2, \ldots, P_q. \text{ In the same priority } P_k, \text{ weights are different that are respectively } \omega_{k1}, \omega_{k2}, \ldots, \omega_k. \text{ Therefore goal programming general mathematical form is:}
\]

Fig. (6). Square contrast activity different ways.
Above is goal programming guiding thoughts, by the guiding thoughts, it studies sports activity that is most suitable to China’s community square fitness, the process is as following.

3.2. Goal Programming Data Processing

According to above goal programming guiding thought, carry on data processing with community square fitness and residents' satisfaction data table, here adopts sequential algorithm here. Sequential algorithm is according to priority order, transforming complicated multiple goals programming problems into multiple simple goal programming problems, its main process is as following:

For \( k = 1, 2, \ldots, q \), it solves

\[
\min z = \sum_{j=1}^{l} P_j \left( \sum_{j=1}^{l} \omega_{kj} d_{j}^+ + \omega_{kj} d_{j}^- \right)
\]

(1)

\[
\sum_{j=1}^{n} a_{ij} x_{j} \leq \left( =, \geq \right) b_{ij}, i = 1, \ldots, m
\]

(2)

\[
\sum_{j=1}^{n} c_{ij} x_{j} + d_{i}^- - d_{i}^+ = g_{ij}, i = 1, \ldots, l
\]

(3)

\[
x_{j} \geq 0, j = 1, 2, \ldots, n
\]

(4)

\[
d_{i}^-, d_{i}^+ \geq 0, i = 1, 2, \ldots, l
\]

(5)

Among them, optimal value is \( z^* \).

At first, most important is residents' satisfaction, therefore it's priority lists the first grade \( P_1 \); secondly, rural sports activities expansion suffered address selection influences, is the second grade \( P_2 \); finally, its expansion conditions also suffered community residents exercise types' influences, which should be the third grade \( P_3 \). It is required residents' satisfaction should be larger than 15%. Therefore, it gets corresponding goal programming model:

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

(6)

\[
5.7x_1+3.2x_2+26.4x_3+11.5x_4+21.4x_5+28.1x_6+3.6x_7 = 7.8x_1+5.4x_2+25.1x_3+15.6x_4+19.7x_5+23.9x_6+2.5x_7 = 20 \]

\[x_1, x_2, \ldots, x_7, d_1^-, d_2^+, d_3^+, d_4^- \geq 0, i = 1, 2, \ldots, 7\]

Calculate above objective function by MATLAB software, and further get goal programming optimal solution is: \( z^* = (3.5, 6) \), and residents' satisfaction is 19.8%.

From above objective function optimal solution, it can get conclusions that equipment, jogging and square dance are best choices to propel to community activities further development and encourage Chinese residents to participate in sports, and residents generally have higher satisfaction with these three sports activities. Analyze from the perspective of field, the three sports activities equipment, field construction and others are very simple without so strictly requirement, and fit for collective activities, and the address is concise. And meanwhile, their technical requirements are not so high, their influences on masses physical and psychological health are also larger that conform to masses in all ages.

CONCLUSION

Firstly, the paper utilizes numerical analysis method and contrastive analysis method to analyze China’s present community activities fitness participants’ main features and various fitness activities proportions, China’s groups’ demands on community sports activities, and then further studies it should start from which group of people to develop China’s community square fitness activities and do propaganda of community sports fitness activities, so that improve different groups consciousness, and let them to pay more attention to community sports activities. Secondly, establish goal programming model, analyze main activities forms about China’s community sports activities fitness and corresponding masses satisfaction, and get sports activity that is most suitable to community residents, and further get the paper conclusion that square dance is optimal solution of goal programming, is a sports activity of the highest masses satisfaction. The result further shows that in case residents satisfaction improves, square dance and other suitable collective activities are most fit for China’s community sports fitness, it should encourage Chinese residents to positive participate in square dance and other collective activities.

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