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Research on logistic analytic hierarchy process-based gymnastics development influence on human physical and psychological health

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ABSTRACT

Gymnastics as a kind of sports leisure event, it not only is able to relief fatigue, build up one's body, but also is helpful for strengthening physique. However, no matter athletes that go in for gymnastics, or civil that regard gymnastics as a kind of leisure event, all the number of people significant change. The paper by Logistic regression analysis, in horizontal view of gymnastics athletes numbers changes, utilizes obtained data to make exact analysis, and further vertically makes comparative study with total number of athletes, and then analyzes recent years' Chinese gymnastics development trend. Utilize analytic hierarchy process to study gymnastics influence on human psychological health, by analyzing gymnastics and chemical medicines curative effects on depressive disorder, anxiety disorder, phobia and obsessive-compulsive disorder these main mental illnesses, it makes quantitative analysis of gymnastics important impacts on human psychological health treatment. It gets conclusion: Chinese gymnastics development is relative slower; gymnasts' numbers are little, especially for international level gymnasts and sports masters. In order to better propel to gymnastics development, give its impacts on human psychological health into play, it should positive encourage teenager and broad civil to take gymnastics exercises, expand gymnastics impacts among public, let gymnastics to develop towards stronger orientations and better serve to public.

KEYWORDS

Gymnastics; Logistic regression analysis; Analytic hierarchy process; Physiology and biochemistry; Psychological health.

INTRODUCTION

Gymnastics is not only a kind of sports event, but also a kind of leisure event. In China, widely spread gymnastics, increase its impacts are both supporting on Chinese sports and promotion to sports culture impacts on public life. And it can also improve human physical quality; strengthen physique, and relief fatigue. By far, there are more scholars have studied gymnastics and got conclusions.

Xiang Xue-Chun put forward current stage gymnastics confronted problems through studying Chinese rhythmic gymnastics development status, and analyzed feasible countermeasures for problems; Zhang Yu-Bao started from gymnastics concepts evolution, researched on competitive gymnastics essence, and compared with basic gymnastics essence, and analyzed gymnastics impacts on people physical and psychological health, and then encouraged public to carry on gymnastics, expanded gymnastics impacts: Guo Fen in competitive gymnastics research, analyzed gymnastics techniques grade standards, and studied gymnastics history and development, and then reviewed gymnastics status, and got conclusions, put forward suggestions on present gymnastics development confronted problems; Wu Wei-Ming started from researching school gymnastics, by analyzing its history and development, he put forward gymnastics problems to be solved, took school gymnastics development and confronted problems as examples, studied Chinese gymnastics development status, and made feasible analysis targeted at current stage status; Tang Xing-Xing in research on modern gymnastics classification, divided gymnastics into competitive gymnastics, basic gymnastics, practical gymnastics and so on, then redid research on them,and then got conclusions.

The paper firstly utilizes Logistic regression analysis method to research on gymnastics development trend, and on this basis, it further studies gymnastics impacts on human physical and psychological health, and then gets that gymnastics is both a kind of sports event and meanwhile a kind of leisure event, develop gymnastics not only can propel to Chinese sports development, but also can build one's body, strengthen physique, it is quite curative to some mental disease treatment.

Model establishments

Gymnastics has abundant contents, and with varies of forms, motions are simple and easy to learn. In addition, gymnastics also have certain impacts on human physical and psychological health, it not only can adjust human blood circulation, relief fatigue, but also is beneficial to strengthen physical quality, build one's body, and also have considerable big impacts on our blood flow, and effective prevent bone deformity and others. Figure 1 is physical gymnastics figure.

Figure 1: Body gymnastics

In ancient times, gymnastics divided into two types, one type are gymnastics that were used to strengthen tendons and bones, prevent diseases, another type was technical gymnastics that reflected in song and dance, acrobatics and operas so on. In Old China, gymnastics development was restricted by social economic development and humanistic factors impacts, and it was further developed in recent times in China.

Chinese gymnastics have gone through rough development progress, from lower starting point, poor foundation to present among world gymnastic rank, it proves Chinese gymnastics development route is correct and can stand historic test.

Chinese gymnasts' development

Chinese gymnastics change from weak to strong, and now it has already entered into world gymnastics. And gymnasts development is related to the whole gymnastics prospects, is the key to Chinese gymnastics further impacting on world sports. Since China started gymnastics, Chinese gymnasts' development has also gone through a changing process. Below TABLE 1 is consulted Chinese gymnasts development correlation data information according to China's statistical yearbook in 2013.

TABLE 1 : Chinese gymnasts' development

Year	Total	International level sports master	Master of sports	First grade sportsman	Second grade sportsman
2008	391		27	141	223
2009	382		25	138	219
2010	379	13	18	140	208
2011	295		29	112	154
2012	245		27	131	87

In table, unfilled data is the information that statistical yearbook hasn't marked in the year.

On the basis of above data, draw it into following broken line Figure 2, so as to better analyze Chinese grade sportsman numbers changes:

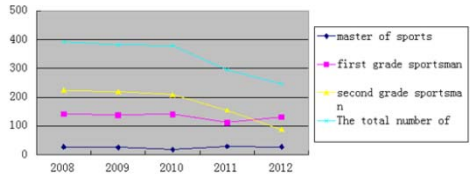

Figure 2 : China's gymnasts number change

From above broken line Figure 2, it is clear that Chinese gymnasts total number are in descending trend, from which master of sports and first grade sportsman sum totals are basically flat, second grade sportsman sum total is in descending trend. In order to further expand gymnastics impacts on China, it should further increase gymnasts amount, cultivate excellent gymnasts to make contributions to Chinese sports.

Chinese sports athletes' numbers status

TABLE 2 : Number of chinese sports athletes

Year	Total	International level sports master	Master of sports	First grade sportsman	Second grade sportsman
2008	46397	148	1798	9754	34697
2009	39450	154	1859	8687	28750
2010	46412	167	1820	9690	34735
2011	38380	300	1675	7580	28825
2012	46341	306	1712	8953	35370

On the basis of data TABLE 2, draw it into following broken line Figure 3 so as to better analyze Chinese grade athletes numbers changes:

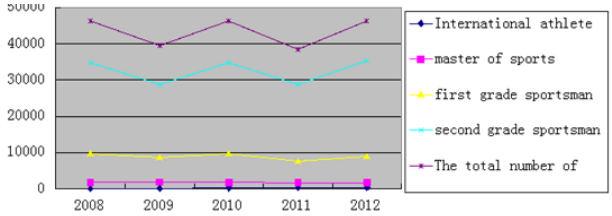

Figure 3 : Our country sports athletes' number change

From above Figure 3,it is clear that Chinese first grade sportsman,second grade sportsman numbers changing amplitude is not big, international level sports master and sports master numbers are relative lower, but total number of people are basically flat. In order to speed up Chinese sports rapidly development, impact on world sports, it should positive cultivate international level sports master, improve athletes' technical levels, and then wholly promote Chinese sports levels, let Chinese sports to steady stand among world sports.

Comparative analysis-based Chinese athletes' numbers and gymnasts numbers analysis

By above analysis of Chinese gymnasts and sports athletes totals, compare the two changes, it can get following conclusions:

(1) Though Chinese sports athletes' total numbers wholly are in the rising trend, gymnasts totals are decreasing by year, it may be little in some time in future, therefore it should expand gymnastics impacts, recruit and cultivate young gymnasts, and propel to Chinese gymnastics development.

(2) Chinese international level sports athletes are relatively little, and from which international level gymnasts are even little, which affects Chinese gymnastics development to a certain extent. Therefore to propel to its development, it should start from world sports perspective, cultivate excellent international level gymnasts.

(3) No matter sports athletes total number or gymnasts, from which master of sports, first grade sportsman and second grade sportsman,all their change amplitudes are not big, basically flat, but gymnasts proportion in total number of athletes are still little, it should positive develop gymnastics in future.

Linear regression analysis-based Chinese gymnasts' numbers research

In order to better analyze gymnasts numbers change, now make linear regression analysis of them, study the two relationships.

Logistic regression basic thought is not directly carrying out regression on y but firstly defining a kind of probability function p,let:

$$p = \Pr(Y = 1 \mid X_1 = x_1, \cdots, X_n = x_n)$$

It requires $0 \le p \le 1$。

And then establish Logistic regression equation: $\log it = a + b_1 * x_1 + b_2 * x_2 + \cdots + b_n * x_n$,and further define regression coefficient.

In the paper, it researches Chinese gymnasts numbers changes, by provided above data, utilizes SPSS software to make data analysis, and gets conclusion. Following is obtained coefficient TABLE 3 by software.

TABLE 3 : Coefficient table

Model		Non-standardized coefficient		Standardized coefficient			B 95.0% confidence interval	
		B	Standard error	Trial version	t	Sig.	Lower limit	Upper limit
1	(Constant)	60.478	24.248		2.494	.243	-247.627	368.583
	Master of sports	-.530	.376	-.035	-1.407	.393	-5.311	4.252
	First grade sportsman	.855	.143	.158	5.979	.106	-.962	2.672
	Second grade sportsman	.999	.026	.891	37.977	.017	.665	1.334

By above data table, it can get gymnasts total number and sports master, first grade sportsman and second grade sportsman's Logistic regression equation: $y = -0.53x_1 + 0.855x_2 + 0.999x_3 + 60.478$

Logistic regression is one kind of linear regression analysis, is a mathematical tool to study variables' correlations, it can help us to use a variable assigned value to estimate another variable assigned value. The model application field is very wide, such as talents demand problem, public security information analysis problem, engineering technical problem and other aspects analysis problems.

By above Logistic regression analysis of Chinese gymnasts numbers changes, it is easily to find that in Chinese gymnasts, sports master and total number of people are in negative correlation, first grade sportsman and second grade sportsman are in positive correlations, but total number of people are correlated to the three linear, and it will increase followed by the three increasing. In order to promote Chinese gymnasts increasing, it should positive cultivate sports master and first grade sportsman as well as second grade sportsman, promote athletes qualities, and establish stronger gymnastics team.

ANALYTIC HIERARCHY PROCESS-BASED CHINESE GYMNASTICS TO BODY PSYCHOLOGICAL HEALTH INFLUENCE RESEARCH

Gymnastics event is a kind of sports leisure activities; it has very important influences on body health. Carry on gymnastics not only can promote physical quality, but also play certain roles in some mental diseases. Below are chemical medicine and gymnastics activity curative effects on depressive disorder, anxiety disorder, phobia, and obsessive-compulsive disorder four kinds of main mental illness, TABLE 4 data is from psychologist Dishman investigation information.

TABLE 4 : Mental illness curative effect comparison

Influence factor Type of illness	Depressive disorder	Anxiety disorder	Phobia	Obsessive-compulsive disorder
Gymnastics	86%	60%	78%	83%
Chemical medicine	74%	57%	69%	79%

Target layer: Mental illness curative effect

Criterion layer: Scheme influence factors, C_1 is depressive disorder, C_2 is anxiety disorder, C_3 is phobia, C_4 is obsessive-compulsive disorder.

Scheme layer: A_1 is gymnastics, A_2 is chemical medicine

Establish following hierarchical structure:

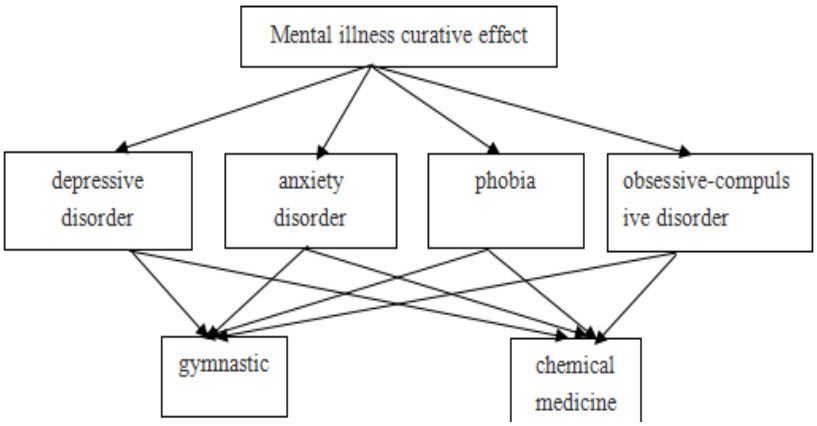

Figure 4 : Hierarchical structure

Depressive disorder, anxiety disorder, phobia, and obsessive-compulsive disorder are common kinds of mental illness; their treatment is important problems in present medical circles. As for these illnesses treatment methods mainly are medicine treatment and sports treatment, from which gymnastics have well curative effects on these kinds of mental illness curing.

Construct paired comparison matrix

Construct paired comparison matrix is carrying on paired comparison among elements, using matrix to express each layer every element importance to previous layer all elements, here apply operational research expert proposed 1~9 ratio scale, as TABLE 5.

TABLE 5 : 1-9 Scale definition

Scale a_{ij}	Definition
1	factor i and factor j have equal importance
3	factor i is slightly more important than factor j
5	factor i is relative more important than factor j
7	factor i is extremely more important than factor j
9	factor i is absolute more important than factor j
2,4,6,8	Indicates middle state corresponding scale value of above judgments
Reciprocal of above numerical values	If compare factor i with factor j, it gets judgment value as, a_{ji} =1/ a_{ji} , a_{ij} =1

According to above scale TABLE 5, set judgment matrix A as:

$$A = \begin{pmatrix} 1 & 3 & 3 & 3 \\ \frac{1}{3} & 1 & 5 & 5 \\ \frac{1}{3} & \frac{1}{5} & 1 & 1 \\ \frac{1}{3} & \frac{1}{5} & 1 & 1 \end{pmatrix}$$

Obviously, A is positive reciprocal matrix.

And constructed scheme layer judgment matrixes correspond to different criterion layers are as following TABLE 6-9:

TABLE 6 : Criterion layer judgment matrix C_1

C_1	A_1	A_2
A_1	1	5
A_2	1/5	1

TABLE 7 : Criterion layer judgment matrix C_2

C_2	A_1	A_2
A_1	1	2
A_2	½	1

TABLE 8 : Criterion layer judgment matrix C_3

C_3	A_1	A_2
A_1	1	3
A_2	1/3	1

TABLE 9 : Criterion layer judgment matrix C_4

C_4	A_1	A_2
A_1	1	4
A_2	1/4	1

Calculate compared element relative weight on the criterion

(1) Consistency test

Consistency indicator: $CI = \frac{\lambda_{\max} - n}{n-1}$

Random consistency indicator:Randomly generate multiple matrixes, add every matrix consistency indicator and then take average value, it gets RI , as TABLE 10.

TABLE 10 : Random consistency indicator

n	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
RI	0	0	0.58	0.90	1.12	1.24	1.32	1.41	1.45	1.49	1.51

Consistency ratio: If $CR = \frac{CI}{RI} < 0.1$,constructed paired comparison matrix A passes consistency test.

(2) Calculate weight

For $A = \begin{pmatrix} 1 & 3 & 3 & 3 \\ \frac{1}{3} & 1 & 5 & 5 \\ \frac{1}{3} & \frac{1}{5} & 1 & 1 \\ \frac{1}{3} & \frac{1}{5} & 1 & 1 \end{pmatrix}$, firstly handling as following:

$$\xrightarrow{Column\ \ vector\ \ normalization} \begin{pmatrix} 0.866 & 0.945 & 0.5 & 0.5 \\ 0.288 & 0.315 & 0.83 & 0.83 \\ 0.288 & 0.063 & 0.167 & 0.167 \\ 0.288 & 0.063 & 0.167 & 0.167 \end{pmatrix}$$

$$\xrightarrow{According\ \ to\ \ the\ \ row\ \ sum} \begin{pmatrix} 2.811 \\ 2.263 \\ 0.685 \\ 0.685 \end{pmatrix} \xrightarrow{The\ \ normalized} \begin{pmatrix} 0.703 \\ 0.566 \\ 0.171 \\ 0.171 \end{pmatrix} = W^0$$

And then,by $A \times W^0$ it further solves $\lambda^0{}_{\max} = 4.246$。

Similarly, criterion layer judgment matrix corresponding maximum feature value and feature vector are successively:

$$\lambda^{(1)}{}_{\max} = 2.874, \omega_1{}^1 = \begin{pmatrix} 0.883 \\ 0.413 \end{pmatrix}; \lambda^{(2)}{}_{\max} = 2.874, \omega_2{}^1 = \begin{pmatrix} 0.883 \\ 0.413 \end{pmatrix};$$

$$\lambda^{(3)}{}_{\max} = 2.865, \omega_3{}^1 = \begin{pmatrix} 0.875 \\ 0.406 \end{pmatrix}; \lambda^{(4)}{}_{\max} = 2.853, \omega_4{}^1 = \begin{pmatrix} 0.873 \\ 0.412 \end{pmatrix}$$

By calculation, it can get paired comparison matrix A maximum feature value $\lambda_{\max} = 4.246$, $RI = 0.90$

By consistency indicator $CI = \frac{\lambda_{\max} - n}{n-1}$,input data,it can calculate and get $CI = \frac{4.242 - 4}{4-1} = 0.081$

And by consistency ratio $CR = \frac{CI}{RI} = \frac{0.081}{0.90} = 0.089 < 0.1$,so constructed paired comparison matrix A passes consistency test. Similarly, it can verify criterion layer judgment matrixes also pass consistency test.

(3) Calculate combination weight vector

By $W^1 = (w_1, \quad w_2, \quad w_3, \quad w_4)$,and $W = W^1 \times W^0$ it can calculate and get $W = \begin{pmatrix} 0.507 \\ 0.273 \end{pmatrix}$.

CONCLUSION

By above combination weight computation result, it can analyze that in mental illness curative effects, gymnastics occupied weight is 50.7%,chemical medicine occupied weight is 27.3%. And then it can get conclusion, gymnastics curative effects on mental illness is far surpassing chemical medicine, and in future it should positive encourage to take gymnastic exercises to strengthen physical quality and mental health, so as to avoid medicine generated side effects on human body. It also proved gymnastics event is not only a kind of sports event, but also a kind of leisure activity, it has very important influences on human physical health, which should be of broad civil concerns.

The paper starts from gymnastics event, by Logistic regression analysis, in horizontal view of gymnastics athletes numbers changes, and further vertically makes comparative study with total number of athletes, and then analyzes recent years' Chinese gymnastics development trend. On the basis of gymnastics, utilize analytic hierarchy process to study gymnastics influence on human psychological health. By analyzing gymnastics and chemical medicines curative effects on depressive disorder, anxiety disorder, phobia and obsessive-compulsive disorder these main mental illnesses, it compares weights and then makes quantitative analysis of gymnastics important impacts on human psychological health. And get gymnastics curative effects on some kinds of mental illnesses are best.

REFERENCES

[1] Chen Po, Qin Zhong-Mei, Yin Ying, Xia Chong-De; Correlation analysis of current situation of regional athletics sports development and society population structure in China, Journal of Beijing Sport University, **30(12)**, 1610-1613 **(2007)**.

[2] Guo Hong; Summary on Chinese sports population research since 1980s, China Sport Science and Technology, **43(3)**, 36-40 **(2007)**.

[3] Li Hong, Xue Hai-Hong, Feng Wu-Long; Sociological analysis of comparison of chinese population with the sports population of Chinese, Journal of Xi'an Institute of Physical Education, **24(4)**, 25-28 **(2007)**.

[4] Li Lin, Yang Jie, Yang Tian, Xu Lie-Hui; A research on the sustainable development of evaluation index system of regional sports industry, Journal of Beijing Sport University, **9**, **(2010)**.

[5] Miao Zhi-Wen, Qin Chun-Lin; Sociological analysis of contemporary Chinese sports population structures, Journal of Physical Education, **13(1)**, 119-121 **(2006)**.

[6] Xiao Huan-Yu, Fang Li; Concept, Classification and statistical criteria of sports population, Sports Science Research, **26(1)**, 7-10 **(2005)**.

[7] Xiao Huan-Yu, Weng Zhi-Qiang, Chen Yu-Zhong; Basic characteristics of social and sports population structures of contemporary China, Journal of Shanghai Physical Education Institute, **29(2)**, 10-14 **(2005)**.

[8] Xue Jin-Xia, Wang Jing-Tong, Analysis on development level of competitive sports of eastern China in the "Eleventh five-year" period, Bulletin of Sport Science & Technology, **19(4)**, 57-59 **(2011)**.

[9] Yan De-Yi; Development of sports for all under circumstance of building well-off society, Journal of Wuhan Institute of Physical Education, **40(1)**, 15-19 **(2006)**.