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Competitive aerobics athlete body function comparative analysis and comprehensive evaluation mode application

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ABSTRACT

The paper studies competitive aerobics athletes body function, after making comprehensive evaluation on one group of competitive aerobics athletes body functions, obtained result is competitive aerobics athletes body function belongs to good level, by making comprehensive evaluation on competitive aerobics athletes body function, it well verifies fuzzy mathematics adaptability and effectiveness, and utilizes performance quantization method, to further research, the paper carries out concrete analysis on three competitive aerobics athletes body function, finally gets the three competitive aerobics athletes body function total performances rank $S_1<S_3<S_2$, and finally proposes methods to promote competitive aerobics athletes body function, and provides theoretical supports for future researching on competitive aerobics athletes body function.

KEYWORDS

Competitive aerobics; Body function; Fuzzy comprehensive evaluation; Comparative analysis.

INTRODUCTION

With aerobics rapidly popularization, in recent years, it has been favored by broad young people, regarding aerobics competitions are also emerging in endlessly, but to promote its comprehensive performances in competitions, it needs to go deeper analysis and research on aerobics athletes body function level.

Regarding aerobics aspect research, formers have made many efforts and obtained abundant achievements, such as : in aerobics optional course students learning evaluation criterion construction with Hebei province as an example, Dong Hui proposed that current Hebei province aerobics students' learning status was not going well, and defined evaluation system, from which it contained emotion attitudes, techniques technology and other aspects that provided evidence for defining standardized evaluation; in aerobics athlete ability structure correlation analysis, Chang Sheng according to aerobics features, applies questionnaire survey, documents literature and other methods to analyze factors that affected athletes' ability, finally got that aerobics would develop towards high completion type, high innovation type, high artistry type and high difficulty type, all kinds of technical motions would be more coordinated till arrive at perfect.

The paper just on the basis of formers research, makes further analysis and researches on competitive athletes' body function, by applying questionnaire survey, mathematical statistics, fuzzy mathematics method and else multiple methods to analyze, and finally gets relative reasonable results, and meanwhile also proves the model rationality and effectiveness.

FUZZY MATHEMATICS-BASED COMPREHENSIVE EVALUATION MODEL THEORETICAL ANALYSES

Competitive aerobics athlete body function suffers many kinds of factors influences, but these factors have fuzzy and uncertainty, apply previous method is difficult to make evaluation, we present fuzzy mathematical comprehensive evaluation model to more reasonable establish competitive aerobics athlete body function comprehensive evaluation system. Make use of maximum membership (remark) and fuzzy linear transformation principle to construct fuzzy comprehensive evaluation such basic thought is the model relative theory, we consider evaluated things related multiple factors influences conditions are considering in case extreme fuzzy, so that realize some purpose of making relative reasonable comprehensive evaluation on another kind of things. So we utilize fuzzy mathematics to carry out comprehensive evaluation, its methods and steps are as following:

At first, it should define evaluated objects that is individual variable affected by n pieces of factors, and its factor set is

u, definition is: $u = (u_{1,}u_2, u_3, \cdots, u_n)$ **(1)**

And regulate

$u_i (i = 1,2,3,\cdots, n)$ **(2)**

Due to each variable weight is different, influences degrees are different to defined judgment grade, we assume its weight allocation is a_i, and:

$a_i = (a_{1,}a_2, a_3, \cdots a_n)$ **(3)**

Among them

$a_i (i = 1,2,3,\cdots, n)$ **(4)**

It is weight of formula (2), according to common sense, we know $a_i \geq 0$ and $\sum_{i=1}^{n} a_i = 1$.

If every factor a_i includes m pieces of sub factors, its factor set is

$u_i = (u_{i,1,}u_{i,2}, u_{i,3}, \cdots, u_{i,m})$ **(5)**

Then corresponding weight value is:

$a_i = (a_{i,1,}a_{i,2}, a_{i,3}, \cdots a_{i,m})$ **(6)**

To $u_{i,j}$ weight value a_i, according to common sense, it is clear $a_{i,j} \geq 0$ and $\sum_{j=1}^{m} a_{i,j} = 1$

Establish an evaluation indicator set

$$v = (v_{1,} v_2, _3, \cdots, v_s) \quad (7)$$

Corresponding evaluation objects can be divided into s pieces of different grades, here, we let $v_{1,} v_2, _3, \cdots, v_s$ to be each merits evaluation degree from high to low, such as excellent, good, qualified, and unqualified so on.

After defining every factor $u_{i,j}$ evaluation indicator evaluation degree, it makes evaluation on factor u_i fuzzy comprehensive evaluation model, we let $u_{i,j}(j = 1,2,3,\cdots,m)$ to be $r_i = (a_{i,1,} a_{i,2}, a_{i,3}, \cdots a_{i,m}) * (r_{i,1})^T, i = 1,2,3,\cdots n$ fuzzy comprehensive evaluation set of evaluation indicators v hypothesis.

It gets required comprehensive evaluation result by fuzzy matrix compound calculation,

That is

$$b = a * r = (a_{1,} a_2, a_3, \cdots a_n) * (r_1, r_2, r_3, \cdots, r_n)^T = (b_1, b_2, b_3, \cdots, b_n) \quad (8)$$

From fuzzy set b, we can make use of maximum evaluation degree method to get a definite evaluation level. Because $B_k = \{B_I\}$, then B_K final evaluation result level is k.

FUZZY MATHEMATICAL COMPETITIVE AEROBICS ATHLETE BODY FUNCTION COMPREHENSIVE EVALUATION

Competitive aerobics athlete body function comprehensive evaluations' individual item scores evaluation

By above, it is known $u = (u_1, u_{2,} \cdots, u_n)$, u_1 is u_i corresponding weight value, u can be defined by investigation, experience statistic and other methods. Take one competitive aerobics athlete body function to make comprehensive evaluation, after that, we combine each kind of factor so that compose of comprehensive evaluation transformation matrix r_1

Comprehensive evaluation a_1

$$a_{11} = u * r_{11},\ a_{12} = u * r_{12},\ \cdots, a_{1n} = u_{1n} * r_{1n}$$

After that we can combine a_{11} into matrix r_{11}

Comprehensive evaluation a_2

$$a_2 = u * r_2$$

Take intersection from above two comprehensive evaluations

Comprehensive evaluation scores

$$b = a * r^T$$

Among them, r^T is r transformation matrix, and r is TABLE 1 scores' matrix form.

TABLE 1 : Parameters allocation

	Score	20	40	80	100
1	Well (first grade, excellent)	0	0	0.25	0.75
2	Good (better than average, good)	0	0	0.50	0.25
3	Normal (middle, qualified)	0	0.25	0.25	0
4	Not good (middle, low grade)	0.25	0..5	0	0
5	Bad (lower grade, unqualified)	0.75	0.25	0	0

Model calculation and resolution:

① Competitive aerobics athlete body function comprehensive evaluation contents are defined, as following Figure 1 shows:

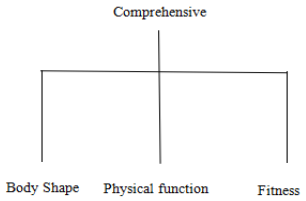

Figure 1 : Body Shape ordinary university college Competitive Aerobics Athletes learn the function of influencing factors Figure

②、Weight value layout

Competitive aerobics athlete comprehensive evaluation(u)——competitive aerobics athlete body function 20%(0.2);competitive aerobics athlete body shape 20%(0.2); competitive aerobics athlete physical quality 60%(0.6)

Competitive aerobics athlete body shape ——upper limb length factor 50%(0.5), lower limb length factor 50%(0.5)

Competitive aerobics athlete body function (u_1)—— motor function 60%(0.6); heart-lung function20%(0.2); brain function20%(0.2)

Competitive aerobics athlete physical quality(u_2)—— waist and abdomen factor 10%(0.1); jumping ability factor5%(0.25); flexibility factor50%(0.5);limbs movement factor 15%(0.15)。

③、We select one group of competitive aerobics athletes of them to carry out individual factor evaluation, its remarks codes are :4、5、5、4、3、4、5、4、4. In the following, we divide athletes comprehensive evaluation into two parts as following :

The group of athletes comprehensive evaluation one is:

Competitive aerobics athlete body function:

$$a_{11} = u * r = [0.5 \quad 0.5]$$

Competitive aerobics athlete body shape:

$$a_{12} = u_2 * r_{12} = [0.20 \quad 0.20 \quad 0.60] * \begin{bmatrix} 0 & 0.25 & 0.50 & 0.25 & 0 \\ 0 & 0 & 0.25 & 0.50 & 0.25 \\ 0 & 0 & 0 & 0.25 & 0.75 \end{bmatrix}$$

$$= [0 \quad 0.05 \quad 0.15 \quad 0.3 \quad 0.5]$$

Competitive aerobics athlete physical quality:

$$a_{13} = u_3 * r_{13} = [0.15 \quad 0.50 \quad 0.25 \quad 0.10] * \begin{pmatrix} 0 & 0 & 0.25 & 0.50 & 0.25 \\ 0 & 0 & 0 & 0.25 & 0.75 \\ 0 & 0 & 0 & 0.25 & 0.75 \\ 0 & 0 & 0.25 & 0.50 & 0.25 \end{pmatrix}$$

$$= [0 \quad 0 \quad 0.0625 \quad 0.3125 \quad 0.625]$$

The group of athletes' comprehensive evaluation two is

$$a_2 = u * r_2 = [0.6 \quad 0.20 \quad 0.20] * \begin{pmatrix} 0 & 0 & 0.0625 & 0.3125 & 0.625 \\ 0 & 0.05 & 0.15 & 0.3 & 0.5 \\ 0 & 0 & 0.25 & 0.5 & 0.25 \end{pmatrix}$$

$$= [0 \quad 0.01 \quad 0.1175 \quad 0.3475 \quad 0.525]$$

The group of competitive aerobics athletes' comprehensive evaluation score is

$$b = a_2 * r^T = [0 \quad 0.01 \quad 0.1175 \quad 0.3475 \quad 0.525] * \begin{bmatrix} 20 \\ 40 \\ 60 \\ 80 \\ 100 \end{bmatrix}$$

$$= 86.7$$

By above, it is clear that the group of competitive aerobics athletes' competitive aerobics body function belongs to good level.

Competitive aerobics athlete body function comprehensive evaluations' multiple-item scores evaluation

According to competitive aerobics features, it needs to establish a factor set about evaluation objects

$$u = (u_1, u_2, u_3, \cdots, u_n)$$

Secondly, according to competitive aerobics athlete body function, it establishes lateral split index 、vertical split index 、standing long jump 、30 seconds push-up、cross jumping test and others six items, corresponding factors use $u_1, u_2, u_3, \cdots, u_6$ to express

$$u = (u_1, u_2, u_3, \cdots, u_6)$$

After that, divide competitive aerobics athletes body function performances successively as : excellent, good, qualified, bad these four grades to evaluate, so corresponding set is $v = \{\text{excellent}, \text{good}, \text{qualified}, \text{bad}\} = \{v_1, v_2, v_3, v_4\}$, we let r_{ij} to be the j factor the i remark possibility extent.

For six aspect three competitive aerobics athletes body functions (S), it carries out evaluation, by evaluation result, it can get :

20%(0.2) excellent, 23% good, 47% medium, 10%qualified and 0% bad, and assign values on them respectively as:5, 4, 3, 2, 1, then corresponding each grade weight can be got by calculation :

Excellent: $5/(1+2+3+4+5) = 0.33$

Good: $4/(1+2+3+4+5) = 0.27$

Medium: $3/(1+2+3+4+5) = 0.2$

Qualified: $2/(1+2+3+4+5) = 0.13$

Bad: $1/(1+2+3+4+5) = 0.07$

By above, it is clear corresponding weights are written into vector as :

$$a = (a_1, a_2, \cdots, a_6) = (0.33, 0.27, 0.2, 0.13, 0.07)$$

Then the thirty people to S_1 athlete six evaluation vectors are respectively :

u_1 evaluation vector is (0.23 0.45, 0.24, 0.1, 0.00)

u_2 evaluation vector is (0.06 0.11, 0.36, 0.31, 0.17)

u_3 evaluation vector is (0.20 0.36, 0.18, 0.17, 0.00)

u_4 evaluation vector is (0.20 0.46, 0.24, 0.10, 0.10)

u_5 evaluation vector is (0.36 0.00, 0.43, 0.13, 0.07)

u_6 evaluation vector is (0.04 0.00, 0.23, 0.16, 0.13)

Through corresponding processing, we get competitive aerobics athletes body functions s_1, s_2, s_3 evaluation matrixes as:

$$r_1 = \begin{pmatrix} 0.23 & 0.06 & 0.20 & 0.20 & 0.36 & 0.04 \\ 0.45 & 0.11 & 0.36 & 0.46 & 0.00 & 0.00 \\ 0.24 & 0.36 & 018 & 0.24 & 0.43 & 0.23 \\ 0.10 & 0.31 & 0.17 & 0.10 & 0.13 & 0.16 \\ 0.00 & 0.17 & 0.00 & 0.10 & 0.07 & 0.13 \end{pmatrix}$$

$$r_2 = \begin{pmatrix} 0.03 & 0.51 & 0.20 & 0.30 & 0.40 & 0.07 \\ 0.10 & 0.27 & 0.36 & 0.40 & 0.37 & 0.37 \\ 0.47 & 0.13 & 018 & 0.17 & 0.00 & 0.40 \\ 0.20 & 0.11 & 0.17 & 0.07 & 0.17 & 0.07 \\ 0.20 & 0.00 & 0.00 & 0.07 & 0.07 & 0.10 \end{pmatrix}$$

$$r_3 = \begin{pmatrix} 0.00 & 0.03 & 0.00 & 0.30 & 0.10 & 0.07 \\ 0.07 & 0.20 & 0.20 & 0.30 & 0.17 & 0.07 \\ 0.23 & 0.17 & 0.63 & 0.27 & 0.67 & 0.20 \\ 0.17 & 0.57 & 0.13 & 0.07 & 0.03 & 0.57 \\ 0.53 & 0.03 & 0.03 & 0.07 & 0.03 & 0.10 \end{pmatrix}$$

Then by fuzzy mathematical evaluation matrix, through corresponding linear transformation, respectively transform three competitive aerobics athletes body functions s_1, s_2, s_3 evaluation matrixes:

Athlete s_1 linear transformation is

$$b_1 = (0.33 \quad 0.27 \quad 0.20 \quad 0.13 \quad 0.07) * \begin{pmatrix} 0.23 & 0.06 & 0.20 & 0.20 & 0.36 & 0.04 \\ 0.45 & 0.11 & 0.36 & 0.46 & 0.00 & 0.00 \\ 0.24 & 0.36 & 018 & 0.24 & 0.43 & 0.23 \\ 0.10 & 0.31 & 0.17 & 0.10 & 0.13 & 0.16 \\ 0.00 & 0.17 & 0.00 & 0.10 & 0.07 & 0.13 \end{pmatrix}$$

$$= (0.24 \quad 0.17 \quad 0.23 \quad 0.27 \quad 0.23 \quad 0.15)$$

Athlete s_2 linear transformation is

$$b_2 = (0.33 \quad 0.27 \quad 0.20 \quad 0.13 \quad 0.07) * \begin{pmatrix} 0.03 & 0.51 & 0.20 & 0.30 & 0.40 & 0.07 \\ 0.10 & 0.27 & 0.36 & 0.40 & 0.37 & 0.37 \\ 0.47 & 0.13 & 018 & 0.17 & 0.00 & 0.40 \\ 0.20 & 0.11 & 0.17 & 0.07 & 0.17 & 0.07 \\ 0.20 & 0.00 & 0.00 & 0.07 & 0.07 & 0.10 \end{pmatrix}$$

$$= (0.17 \quad 0.28 \quad 0.29 \quad 0.24 \quad 0.26 \quad 0.22)$$

Athlete s_3 linear transformation is

$$b_3 = (0.33 \quad 0.27 \quad 0.20 \quad 0.13 \quad 0.07) * \begin{pmatrix} 0.00 & 0.03 & 0.00 & 0.30 & 0.10 & 0.07 \\ 0.07 & 0.20 & 0.20 & 0.30 & 0.17 & 0.07 \\ 0.23 & 0.17 & 0.63 & 0.27 & 0.67 & 0.20 \\ 0.17 & 0.57 & 0.13 & 0.07 & 0.03 & 0.57 \\ 0.53 & 0.03 & 0.03 & 0.07 & 0.03 & 0.10 \end{pmatrix}$$

$$= (0.12 \quad 0.18 \quad 0.20 \quad 0.24 \quad 0.22 \quad 0.16)$$

We get corresponding set from three competitive aerobics athletes body functions linear transformation as:

$$b=\begin{pmatrix}0.24 & 0.17 & 0.12\\ 0.17 & 0.28 & 0.19\\ 0.23 & 0.29 & 0.20\\ 0.27 & 0.24 & 0.24\\ 0.23 & 0.26 & 0.22\\ 0.15 & 0.21 & 0.16\end{pmatrix}$$

Targeted at competitive aerobics athletes body functions, referencing formers research results, we can get corresponding weights table, and combine with the paper contents, we can get:

$$A=(a_{11},a_{22},a_{33})*b=(0.20 \quad 0.10 \quad 0.10 \quad 0.25 \quad 0.15 \quad 0.20)*\begin{pmatrix}0.24 & 0.17 & 0.12\\ 0.17 & 0.28 & 0.19\\ 0.23 & 0.29 & 0.20\\ 0.27 & 0.24 & 0.24\\ 0.23 & 0.26 & 0.22\\ 0.15 & 0.21 & 0.16\end{pmatrix}$$

$$=(0.22 \quad 0.23 \quad 0.19)$$

By above, it is known that three competitive aerobics athletes' body function comprehensive evaluation scores vectors $A_1=0.22, A_2=0.23, A_3=0.19$, then corresponding ranking is : A_2 is larger than A_1 is larger than A_3. So we can get three competitive aerobics athletes body functions sports performances every indicator and individual scores results as TABLE 2:

TABLE 2 : Three athletes' sports performances every indicator individual scores

Factor u_i	**Lateral split index** u_1	**Vertical split index** u_2	**Standing long jump** u_3	**30 seconds push-up** u_4	**Cross jumping test** u_5	**30 seconds abdomen contracting and leg raising** u_6	$\sum$
Weight a_{ij}	0.20	0.10	0.10	0.25	0.15	0.20	1.00
Competitive aerobics athlete s_1	0.05	0.03	0.02	0.06	0.02	0.05	0.22
Competitive aerobics athlete s_2	0.05	0.03	0.03	0.04	0.03	0.06	0.24
Competitive aerobics athlete s_3	0.04	0.02	0.02	0.03	0.02	0.04	0.18

By above TABLE 2, we can know that even competitive aerobics athletes body function s_2 in 30 seconds push-up is lower than s_1, but in lateral split index, 30 seconds abdomen contracting and leg raising and else other five aspects are not low, some are even surpassing competitive aerobics athlete body function s_1, so s_2 in total competitive aerobics body function performance is superior to s_1, and s_3 each item performance is lower than s_1, so the three competitive aerobics athletes body functions comprehensive ranking is : $s_1 < s_3 < s_2$。

CONCLUSION

By making comprehensive evaluation on competitive aerobics athletes body function, it well verifies fuzzy mathematics adaptability and effectiveness, and utilizes performance quantization method, after making comprehensive evaluation on one group of competitive aerobics athletes body functions, obtained result is competitive aerobics athletes body function belongs to good level, to further research, the paper carries out concrete analysis on three competitive aerobics athletes body function, finally gets the three competitive aerobics athletes body function total performances rank

$S_1 < S_3 < S_2$, by above result, we can summarize that future if competitive aerobics athletes want to promote their body functions, they should strengthen their exercises so as to improve their body comprehensive function levels.

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