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Teenagers aerobics players-based evaluation system analysis and physical abilities features research

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ABSTRACT

The paper researches on teenage woman aerobics athlete' physical qualities, functions, body shapes, tests on random selected 15 athletes, and establish physical fitness indicators, by applying biomechanics, mathematical statistics, principal component analysis, and questionnaire as well as other analyses methods, it establishes relations among indicators and defines weights, applies percentage method to set teenagers comprehensive physical fitness evaluation criterion, finally it gets every athlete evaluation system that provides theoretical support for teenagers improving aerobics. © 2014 Trade Science Inc. - INDIA

KEYWORDS

Female aerobics;
Physical fitness feature analysis;
Evaluation system;
Principal component analysis;
Physical fitness features.

PREFACE

Aerobics hasn't yet developed until 1980s in China, it is a kind of young and charming sports event for the youth; in 1994, international accepted aerobics such event, as a competitive event, it got further improvements.

Formers have made lots of efforts on aerobics event research, such as: Zhang Hong-Zhen and others' mentioned in their high level aerobics players' physical abilities research that aerobics sports skill mainly relied on athletes' physical abilities levels to let it fully improve, he found out its main effective factors by applying factor analysis method, respectively carried out systematic analysis on male and female aerobics on the basis of such method, and made guiding opinions that athletes should focus on majors as well as others during the event training; in the article "15-17 years old aerobics players' evaluation system, Wang Fang proposed to apply principal component analysis method to define evaluation

indicators and presented his own understandings on male and female aerobics players' development.

The paper just establishes on the basis of formers, it goes deeper research on Teenage woman aerobics athlete' comprehensive qualities, which plays better roles in promoting teenagers aerobics comprehensive abilities in future, and researches on aerobics athletes' physical abilities, which provides theoretical support for future teenagers aerobics athletes' selection.

TEENAGERS AEROBICS PLAYERS' EVALUATION SYSTEM ESTABLISHMENT MODEL

Weight defined mathematical model

For teenagers' female aerobics players' evaluation system researches, the paper adopts questionnaire, expert interview and other ways to define evaluation indicator system weight, its steps are as following:

In order to define indicator weight, the paper adopts

questionnaire way to experts, and combines with evaluation method to make researches and defines each grade indicator weight value.

For indicator i corresponding experts endowed weight value λ_{ij} , that:

$$\lambda_{ij} = \frac{u_{ij}}{\sum_{r=1}^n u_{rj}}$$

Among them, number of first grade indicators is expressed by n , first grade indicator r is up to expert

TABLE 1: Teenage woman aerobics athlete' physical fitness indicator system weight table

Type	Weight	Second grade indicator	Third grade indicator	Weight
Body Shape S	0.28	S1 lower limbs length factor	S11 height	0.26
		S2 upper limbs length factor	S21 finger spacing	0.26
		S3 structural proportion factor	S31 chest, hip circumference	0.25
		S4 body composition factor	S41 Quetelet Index	0.20
Body function X	0.28	X1 motor function factor	X11 creatine kinase	0.56
		X2 lung capacity factor	X21 lung capacity/height	0.47
Physical quality Y	0.36	Y1 flexibility factor	Y11 sit-up	0.30
		Y2 waist and abdomen factor	Y21 push-up	0.27
		Y3 jumping ability factor	Y31 comprehensive flexibility	0.20
		Y4 upper limbs factor	Y41 vertical jump	0.19

TABLE 2 : Teenage woman aerobics athlete' physical fitness indicator scoring standard table

Indicator	S11	S21	S31	S41	X11	X21	Y11	Y21	Y31	Y41
0	86.5	338.6	47.38	-3.5	1099	35.12	52.6	20.3	25.5	20.
1	87.23	336.4	48.65	-3.41	912.3	36.47	53.4	21.6	26.3	21.36
2	87.85	334.8	49.12	-3.22	724.9	37.54	56.7	22.4	27.4	22.5
3	88.24	332.1	49.34	-3.14	658.4	38.29	58.4	23.8	28.1	23.4
4	88.67	330.6	49.57	-2.86	567.1	39.81	60.2	24.9	29.5	24.6
5	89.32	327.4	49.89	-2.74	512.8	40.23	61.4	25.7	30.2	25.8
6	89.97	326.2	50.47	-2.61	485.9	41.54	62.8	26.4	31.5	26.7
7	90.12	325.7	50.51	-2.42	457.9	42.67	63.3	29.8	32.6	28.2
8	90.48	323.9	50.76	-1.56	438.6	43.82	64.8	30.4	33.7	29.1
9	91.34	321.5	50.98	-1.28	414.2	44.91	68.5	31.5	33.89	30.3
10	91.58	319.8	51.23	0.23	396.4	46.32	70.6	32.8	33.98	31.9
11	92.41	318.6	51.46	1.14	384.7	48.96	72.4	36.2	34.11	32.4
12	92.73	316.4	51.79	1.65	376.6	50.24	74.6	37.4	34.23	33.5
13	93.29	314.8	51.84	1.84	364.2	52.78	78.9	38.9	34.43	34.7
14	93.85	310.5	51.89	2.36	347.5	54.69	82.3	39.5	34.58	35.9
15	94.54	305.7	51.92	2.75	325.6	55.36	84.6	40.2	34.96	36.1
16	94.73	303.9	51.98	3.44	301.4	56.75	86.7	42.5	35.24	37.4
17	95.6	301.1	52.01	3.89	288.4	57.24	89.2	43.4	35.64	38.2
18	96.47	297.4	52.24	4.23	267.5	58.91	90.3	48.6	35.85	39.1
19	97.38	292.6	52.36	4.65	244.9	59.64	92.4	50.3	36.24	40.5
20	98.67	290.3	52.47	5.77	236.1	60.11	96.5	51.4	37.84	

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TABLE 3 : Teenage woman aerobics athlete' physical fitness indicator scoring table

No.	S11	S21	S31	S41	X11	X21	Y11	Y21	Y31	Y41
1	9	6	12	10	9	8	18	5	9	16
2	5	9	9	8	5	9	9	9	4	5
3	7	4	6	20	7	4	8	4	11	8
4	3	18	14	16	3	11	11	12	18	14
5	5	12	18	5	5	18	7	15	20	7
6	9	11	20	9	9	20	13	17	9	9
7	4	9	7	5	4	9	5	10	17	4
8	12	6	3	7	12	17	7	8	7	12
9	15	16	14	3	15	5	3	20	3	15
10	17	5	18	5	17	13	5	18	14	17
11	10	8	9	5	10	12	9	12	18	11
12	8	14	8	13	8	11	4	11	9	18
13	20	7	11	12	20	9	9	9	8	20
14	16	6	7	11	16	6	14	6	0	9
15	7	15	13	9	7	16	12	15	11	17

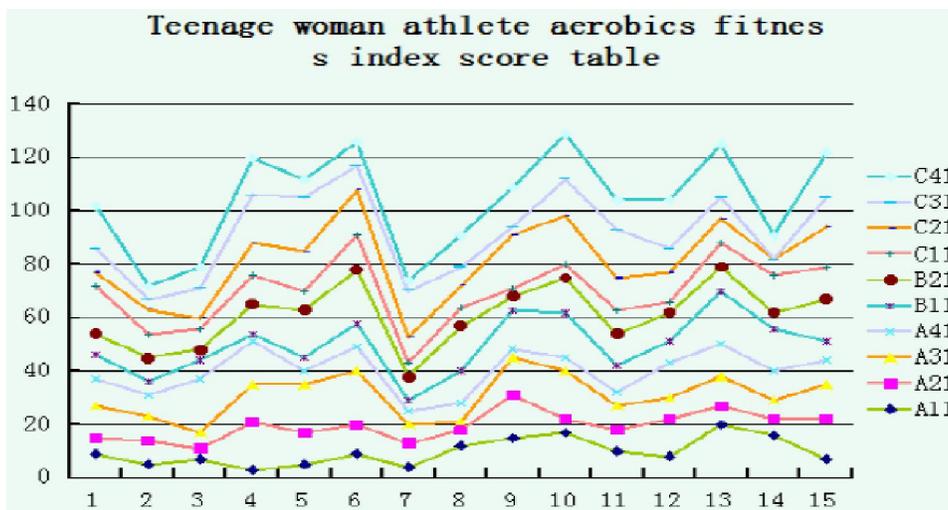


Figure 1: Teenage woman athlete aerobics fitness index score chart

TABLE 4 : Teenage woman aerobics athlete physical fitness indicator scores (weighting)

No.	S11	S21	S31	S41	X11	X21	Y11	Y21	Y31	Y41
1	6.54	6.81	6.54	5.64	2.21	1.97	7.48	7.48	1.64	4.21
2	6.81	7.48	6.81	6.54	0.65	1.64	1.23	1.23	5.47	6.81
3	7.48	1.23	7.96	6.81	2.36	5.47	2.54	2.54	4.21	1.15
4	4.34	2.54	1.02	7.48	1.47	4.21	5.64	5.64	6.81	6.54
5	4.87	1.97	1.15	7.96	6.81	6.81	6.54	6.54	1.15	6.81
6	5.22	1.64	1.31	1.15	7.48	1.15	6.81	6.81	1.31	7.48
7	1.47	5.47	2.52	1.31	1.23	2.36	7.96	5.47	6.81	1.23
8	1.15	4.21	4.87	2.52	2.54	1.47	1.02	4.21	1.15	2.54
9	2.23	6.81	5.22	6.81	1.97	1.15	1.23	6.81	1.31	1.23

No.	S11	S21	S31	S41	X11	X21	Y11	Y21	Y31	Y41
10	1.47	7.96	6.81	7.48	1.64	1.31	2.54	1.15	2.52	2.54
11	1.15	8.12	7.48	1.23	2.36	2.52	5.64	6.54	6.81	1.97
12	1.31	5.97	1.23	2.54	1.47	6.81	6.54	6.81	7.48	1.64
13	2.52	1.24	2.54	4.2	1.15	7.48	6.81	0.88	1.23	5.47
14	6.81	3.23	4.2	2.32	1.31	1.23	7.96	3.19	4.23	2.1
15	7.48	5.47	1.23	4.34	6.81	1.45	2.57	1.45	4.34	1.05

TABLE 5: Teenage woman aerobics athlete special physical fitness first grade indicator scores table (no weighting)

No.	S Score	X Score	Y Score
1	9.6	10.36	9.6
2	6.8	10.09	6.8
3	6.06	13.35	9.19
4	7.58	1.94	12.83
5	8.98	12.38	16.84
6	9.65	7.43	12.35
7	11.23	11.3	14.24
8	14.41	6.26	16.47
9	5.35	9.99	11.46
10	4.54	5.23	7.94
11	7.56	8.47	6.06
12	3.60	11.57	7.58
13	7.94	13.94	7.34
14	6.35	14.35	7.56
15	4.12	12.53	8.76

TABLE 6 : Teenage woman aerobics athlete physical fitness first grade indicator scoring status (weighting)

No.	S Score	X Score	Y Score	Comprehensive score
1	3.39	4.69	2.24	12.96
2	3.82	1.40	5.60	9.17
3	5.58	3.11	2.47	6.56
4	1.84	1.65	3.94	11.15
5	3.16	2.23	1.87	6.64
6	5.61	0.95	3.14	12.58
7	2.47	3.62	5.14	10.63
8	1.28	1.48	4.28	13.84
9	6.84	2.48	3.47	7.65
10	3.94	4.69	1.06	7.78
11	4.64	6.13	4.26	5.26
12	1.51	3.68	3.63	1.48
13	2.46	2.47	3.93	9.57
14	3.18	1.17	3.52	7.87
15	2.18	2.39	1.28	9.14

j to endow weight u_{ij} , first grade indicator i is up to expert to endow weight, and then for indicator I weight corresponding coefficient is λ_i , so it has:

$$\lambda_i = \frac{1}{14} \sum_{j=1}^n \lambda_{ij}$$

According to above method, and by investigation and researching, we define aerobics players' special physical indicators' three grades weight values. As following TABLE 1 show:

Set scoring standard

In order to better measure teenagers female athletes' physical abilities indicators, the paper adopts a kind of percentile method to evaluate, the method divides into rating scale and scoring scale two tables, and its reference point is firstly ranking with original data and then comparing with total number of people; in order to more easily calculate, the paper uses a kind of

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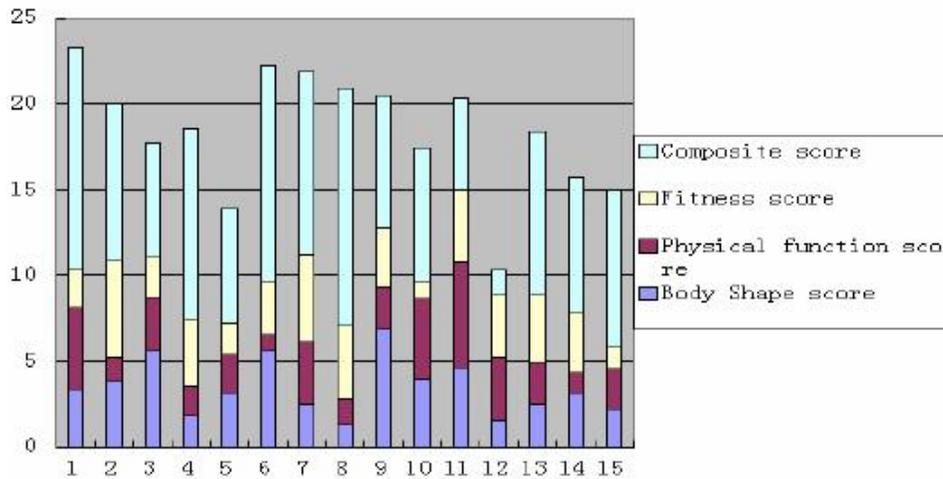


Figure 2 : Teen athlete aerobics fitness level indicators scores (weighted)

TABLE 7: Teenage woman aerobics athlete physical fitness first grade indicator grade evaluation standard table

Grade	Superior	Above the average	Medium	Below the average	Inferior
	90%	75%—90%	25%—75%	10%—25%	10%
S	13.57	11.47~13.56	7.77~11.46	6.25~7.76	6.24
X	13.68	12.79~13.67	7.67~12.78	4.28~7.66	4.27
Y	14.98	12.46~14.97	7.50~12.45	4.57~7.49	4.56

TABLE 8 : Teenage woman aerobics athlete physical fitness first grade indicator grade evaluation standard table

No.	S grade	X grade	Y grade
1	Below the average	Below the average	Medium
2	Medium	Below the average	Above the average
3	Medium	Above the average	Medium
4	Below the average	Below the average	Above the average
5	Above the average	Medium	Below the average
6	Above the average	Inferior	Above the average
7	Medium	Above the average	Superior
8	Below the average	Medium	Above the average
9	Superior	Above the average	Medium
10	Medium	Above the average	Below the average
11	Above the average	Superior	Above the average
12	Medium	Above the average	Above the average
13	Medium	Above the average	Above the average
14	Superior	Inferior	Medium
15	Medium	Medium	Below the average

value to be defined as 20 scores, and define above indicators values with 5 as gap into 1-19 scores, minimum one is 0. Based on above process, it establishes teenagers' female aerobics physical abilities scoring standard table, as following TABLE 2 show:

TEENAGE WOMAN AEROBICS ATHLETE' PHYSICAL FITNESS INDICATOR SCORING STANDARD APPLICATION

The paper takes previous athletes that participated in world teenagers aerobics competition as examples, selects 15 female aerobics players as research objects, and make systematic testing, its result is as following TABLE 3 show:

In order to more clearly present teenage woman aerobics athlete physical fitness test scoring status, the paper draws broken line graph, as following Figure 1 show:

By above graph, we easily can see that teenage woman aerobics athlete scores in any event and mutual high-low status, therefore it realizes teenage woman aerobics athlete physical fitness test indicators comparison.

recently popular method—percentile method, the method is a kind of ways for single indicator scoring, to apply the method, it should find out research objects' minimum value and maximum value, then calculate indicator values with 5 as gap, after that we let maximum

Weighted comprehensive evaluation

According to above every teenage woman aerobics athlete scoring status, to realize physical fitness comprehensive evaluation indicator, it should weighting on it, its formula is:

$$B = \sum a_i * b_i$$

Among them, in above formula a_i represents scoring status, and b_i represents weight value. To make comprehensive evaluation on it, the paper designs some steps to proceed:

- ① According to three grades weight values in first grade indicator, it calculates teenage woman aerobics athlete each indicator scoring status after weighting, as following TABLE 4 show:
- ② According to above each indicator scores without weighting in case weighting, it calculates first grade indicator scoring status in case no weighting, for example teenager relative woman body shape scoring status is got by formula $S_{11} + S_{21} + S_{31} = S$, according to the model, we can get each item score, as following TABLE 5 show:
- ③ According to first grade indicators weights differences, it can calculate teenage woman aerobics athlete first grade indicators scoring status after weighting, and solve the sum of them, and its formula is:

$$X + Y = S$$

So that can get teenage woman aerobics comprehensive physical fitness test results, as following TABLE 6 show:

Draw above aerobics woman athlete first grade indicators' scoring status into bar chart form, as following Figure 2 show:

By above table, we easily see that the 15 teenage aerobics athletes physical fitness test comprehensive ranking status and each indicator's rank.

GRADE EVALUATION AND COMPREHENSIVE EVALUATION RESEARCH

In order to objectively establish comprehensive physical fitness and first grade indicator mutual relations, we can divide grade evaluation into five kinds of evaluation ways according to evaluation and measurement theories, which are respectively inferior, below

the average, medium, above the average, superior these five kinds, and the paper adopts percentile method, due to its simplicity and accuracy, relative scholars also generally use the method in recent years. So it establishes teenage woman aerobics athlete comprehensive physical fitness and physical fitness first grade indicator evaluation criterion with the method, as following 7 shows:

By above evaluation criterion, we can get teenage woman aerobics athlete first grade indicator grade evaluation result, as following TABLE 8 show:

By above TABLE 8, we can clearly see 15 women athletes' comprehensive physical fitness and each first grade indicator aspect differences and connections.

CONCLUSIONS

The paper makes researches on teenage woman aerobics athlete physical fitness, by applying biomechanics, kinematics and statistics so on methods, it researches on body functions; by drawing teenage woman aerobics physical fitness test scoring status, we easily see that women athletes any one item scoring status and mutual high-low status, after that the paper establishes aerobics athletes' first grade indicator scoring status, we can see by figure that random selected 15 athletes' physical fitness test ranking and mutual comprehensive ranking, finally it gets every athlete different grade, which plays guiding roles in teenage aerobics woman athlete physical fitness test correlation research.

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