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A study on the change tendency of difficulty elements in aerobic gymnastics competitions under the new rules

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ABSTRACT

With the methods of literature consulting and interviews, the paper studied the changes as to difficulty elements of the 2013-2016 new competition rules and tries to explore the change tendency of difficulty elements in aerobic gymnastics competitions under the new rules. Research conclusions are as follows: (1) the new rules regulate difficulty elements into 22 base of the groups and enlarge the choice scope of difficult elements; (2) extreme difficulty and novelty continue to be the goal of difficult elements, which requires athletes' even stronger physical stamina and higher training skills; (3) in the new competition term, lack of group and reduction of scores is not restricted by objective factors and great attention is paid to difficulty combination in terms of adapting whole sets of difficult elements; (4) fairness should be embodied in the male-and-female-in-the-same-group competition and the difficulty coefficient should be further lowered.

Key words: aerobic gymnastics, difficulty, development tendency

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INTRODUCTION

Aerobic gymnastics is a sport which shows, with the accompaniment of music, a complete set of continuous, complex and high-tension actions, while competition rules refers to the regulatory documents the competitions are based on and according to which, the coaches arrange their training effectively to improve competitors' competition ability. Difficult elements, the frame of a complete set of aerobic gymnastics, are not only the key factor to reflect difficulty and beauty of aerobic gymnastics, but its technical level is also the dominative tendency of aerobic gymnastics development [1]. Having analyzed the differences of difficulty elements between 2009-2012 competition rules and the 2013~2016 ones, the paper tried to probe into the tendency of difficulty elements of aerobic gymnastics competition.

EXPERIMENTAL SECTION

2.1. Research subjects

The study is based on the analysis of the FIJ 2009~2012 and 2013~2016 competition rules in the Aerobic Gymnastics.

2.2. Research methods

2.2.1. Literature consulting

The author reviewed the FIJ 2009~2012 and 2013~2016 competition rules in the Aerobic Gymnastics, the 2010 and 2012 World Aerobics Championship Video and grade books and more than 20 papers about rules change in the Aerobic Gymnastics and so on, in order to provide a theoretical basis for the study.

2.2.2. Interviews

The author interviews experts and scholars, aerobics coaches and judges on the changes of the aerobic gymnastics

competition rules to explore the tendency of difficulty elements in the aspects of movement selection and training in the new cyclical competitions.

RESULTS AND DISCUSSION

3.1. The analysis of the changes of difficulty elements in aerobic gymnastics' new rules

3.1.1. The new rules integrated and restructured the difficulty elements into group base name, first put forward the concept of the group base name

In 2013-2016 version of the rules, the International Gymnastics Federation reintegrated difficulty elements with similar coefficient and technical characteristics into the group base names, first putting forward the concept of group base names, allowing up to 10 difficulty elements from different group base names [2].

Table 1 shows that the capoeira with twist was deleted in group A, and the former 10 base names was integrated into 5 group base names, among which, "a Frame" and "cut" are the two typical choices of strength-typed players in the last competition term, while they fell into "the plio push up" in this term. If the competitors perform both of them at the same time, 1.0 points will be subtracted by the judge for repeating performing difficulty elements.

Table 1. Comparison between difficulty elements' base names in the old rules and the according family group names in the new ones in group A

Code of Points 2009-2012	Code of Points 2013-2016
Push up	Push up (PU, Wenson PU)
Wenson push up	Explosive Push up (Plio PU, A Frame, Cut)
Plio push up	Explosive Support (High V and Reverse Cut)
A Frame	Leg circle (Leg circle, Flair)
Cut	Helicopter (Helicopter)
V & High V support	
Leg circle	
Flair	
Helicopter	
Capoeira with twist	

Table 2 shows that the former 6 base names was integrated into 3 group base names, among which, "Straddle" and "L-Support" are the two typical choices in the last competition term, while choosing them both at the same time in this term will be viewed as repeated difficult action choice. Thus it is hard for non strength-typed athletes to gain higher scores by doing two difficult elements in group B as they used to do.

Table 2. Comparison between difficulty elements' base names in the old rules and the according family group names in the new ones in group B

Code of Points 2009-2012	Code of Points 2013-2016
Straddle Support	Support (Straddle Support，L-Support)
L-Support	V- Support(V-Support, High V-Support)
V-Support	Horizontal Support (Wenson Support, Lever Support, Planche)
Wenson support	
Lever Support	
Planche	

Table 3 shows that two new difficulty elements including OFF AXIS JUMP(OFF AXIS ROTATION) and BUTTERFLY JUMP(BUTTERFLY) were added in group C, that the former 13 base names was integrated into 9 group base names. Only three elements remain in the BUTTERFLY JUMP (BUTTERFLY) family group with 0.8 as the highest score, leaving a lot of improvement room. In 8th-11th Gymnastics World Championships, "Cossack jump"was performed most by the first six places winners of every events in their complete sets of movements, accounting for 17.4% of the total number of complete sets of difficulty elements；then was "Pike jump"，taking up 16.2%, and the third is the "Tuck jump", which took up15.8% of the total number of complete sets of difficulty elements [3]. But in the new term of competition, "Tuck jump" and "Cossack jump" fall into the same family group, the BENT LEG JUMP, so competitors cannot perform them at the same time. Another example is the Split jump, for which especially female athletes used to perform Scissors leap turning 180^{o} and then Splitting 360^{o} longitudinal cheating on the ground, and even then do Switch split leap 180^{o}, a longitudinal cheating on the ground. This series of difficulty elements now fall into one family group, performing up to two of them at the same time will be viewed as repeat and a deduction will be made.

Table 3. Comparison between difficulty elements' base names in the old rules and the according family group names in the new ones in group C

Code of Points 2009-2012	Code of Points 2013-2016
Air turn	Straight Jump (Air turn, Free fall)
Free fall	Horizontal Jump(Gainer, Tamaro)
Gainer	Bent Leg Jump (Tuck, Cossack)
Sagital scale to push up	Pike Jump (Pike)
Tuck jump	Straddle Jump (Straddle, Frontal split)
Straddle jump / leap	Split Jump (Split ,Switch, Scissors leap)
Cossack jump	Kick Jump (Scissors Kick)
Pike jump	Off Axis Jump (Off Axis Rotation)
Split jump / leap	Butterfly Jump (Butterfly)
Frontal split jump	
Switch split leap	
Scissors Kick	
Scissors leap	

Table 4 shows that the capoeira with twist was deleted in group D and balance turn was added to the turn family group, and that the former 7 base names was integrated into 5 family group names. Taking it into consideration that most of the athletes would choose balance turns like the Illusion and Balance turn, etc. the new rules maintained their current category as different groups.

Table 4. Comparison between difficulty elements' base names in the old rules and the according family group names in the new ones in group D

Code of Points 2009-2012	Code of Points 2013-2016
Turn	Split (Split, Frontal split, Vertical split with turn)
Balance	Turn (Turn, Turn with leg at horizontal)
High Leg Kicks	Balance turn (Balance turn)
Sagital Split	Illusion (Illusion)
Frontal Split	Kick (High leg kicks)
Illusion	
Capoeira	

3.1.2. The change of difficulty elements' number and score in new rules

The data of table 5 shows that despite certain adjustment and reduction and decrease of the total numbers of difficulty elements in 2013-2016 new rules, the number of 0.9-1.0 high score difficulty elements was increased. Since the final score is correlated to the score of difficulty movement, the score of difficulty movements directly influences the result of the competition [4]. The new rules provided more choices for athletes to do high difficulty elements to better their performance. The number decrease of difficulty elements in group B and group C was due to the value decrease of some old difficulty elements.

Table 5. The number comparison of difficult elements between old and new rules

	A group		B group		C group		D group		total	
	old	new	old	new	old	new	old	new	old	new
0.1	2	1	0	0	0	0	6	3	8	4
0.2	5	7	5	3	3	3	8	3	21	16
0.3	7	7	5	7	14	13	8	6	34	33
0.4	8	10	7	7	24	25	8	6	47	48
0.5	9	9	8	10	34	32	9	8	60	59
0.6	7	7	10	10	38	35	7	11	62	63
0.7	9	11	9	7	31	23	5	8	54	49
0.8	7	5	5	4	20	14	3	6	35	29
0.9	5	5	2	2	9	9	1	3	17	19
1.0	4	4	1	2	7	8	1	3	13	17
total	63	66	52	52	180	162	56	57	351	337

The analysis of difficulty value changes of the group A: a. except that the scores of Push up and EXPLOSIVE PUSH UP remain the same with those of the last term, a deduction of 0.1-0.2 was made in other difficulty elements such as A Frame, Cut, Flair and Helicopter etc.; b. the difficulty value of partial Cut was increased and the value of Wenson push up and partial Cut turning 180^{o} which strength-typed players often choose remain unchanged. But the new rules require higher-quality performance, that is to say, it must meet the technical specifications of the first cut after turn, avoiding making straddle hip technology form.

The analysis of difficulty value changes of group B: a. the group of Combined Supporting Body and Arm Twisting

got a 0.1 points decrease; b. the value of movement of the Split Level into Wenson back Split Level which were typically performed is reduced from 1 to 0.9; c. the family of Leg Level increased by 0.1-0.2; d. L-Support and V-Support gained a 0.1point increase.

The analysis of difficulty value changes of group C: a. the value of most difficulty elements kept unchanged, except for Pike Jump family, which got a 0.1deduction. For example, the score of Split Jump/Leap reduced from 0.4 to 0.3; Turn 180º Pike Jumped to 180º into Front Support reduced from 0.8 to 0.7. b. the score of Straddle Jump/Leap, Split Jump/Leap, Cossack Jump, Pike Jump reduces by 0.1. An typical example was Cossack Jump 360º, which reduces 0.7 to 0.6.

The analysis of difficulty value changes of group D: the value of D group had no change, but 14 difficulty elements with the value above 0.6 were added into this group, from which we can see that new rules require more flexibility and balance of athletes.

The data of table 6 shows: In old rules, there were 13 1.0-point difficulty elements, of which 6 elements remained unchanged; 1 element was removed, the rest 6 elements gat a 0.1-0.2 point reduction. In new rules, there are 17 1.0-point difficulty elements, of which 6 elements remained and 2 elements were increased to 1.0 point, and the other 9 elements are newly added. These changes implied that the difficulty elements were developing toward a higher, more difficult, more novel direction. Therefore, in order to get higher difficulty elements scores, competitors must enhance their comprehensive athletic ability and improve technique level to better high-value difficulty movements. Hence, training must be more scientific and systematic which required competitors to reinforce their strength and technical training. Only stick to this key to the success can they perform difficulty movements well.

Table 6. The comparison of 1.0 difficulty elements in old rules and new ones

group	2009-2012 Version of the rules 1.0 difficulty towards					2013-2016 Version of the rules 1.0 difficulty source				
	maintain	descend 0.1	descend 0.2	delete	total	maintain	rise 0.1	rise 0.2	newly increased	total
A	1	1	2	0	4	1	0	0	3	4
B	0	1	0	0	1	0	1	1	0	2
C	4	2	0	1	7	4	0	0	4	8
D	1	0	0	0	1	1	0	0	2	3
total	6	4	2	1	13	6	1	1	9	17

3.1.3. The changes of the evaluation method of Category difficulty

In the 2009-2012 version old rules, category difficulty means that there had to be an independent action in each of the A, B, C, D four groups to perform a complete set of movements [5]. Neither the error action scoring "0" nor difficulty movements in combinations were considered as category difficulty. Both movement adoptions and competitors' performance affect penalty for missing group movements. For example, two difficulty movements in group A were arranged in a complete set of action, one is the Pike Jump and then A Frame，achieving the difficult combination score of 0.1 points for meeting the minimum standards; Another is High V and Reverse Cut and then Wenson Support, getting 0 point for failing. Thus because A Frame of group A did not independently accomplished, the evaluation result is missing group A difficulty and 1.0 points being subtracted by the difficult judge. It was not common to get a reduction for missing group difficulty movements in high-level competition in the last competition term, but common in the misfired or the middle and lower level game. This is undoubtedly worse, and it seriously influences the athletes' grades and ranks.

In the 2013-2016 version new rules, category difficulty means that at least one difficulty movement in each group had to be performed, the difficulty movement with the zero points and that in combinations would be regarded as effective difficulty movements. So in this competition term, no deduction would be made for error actions or missing group difficulty combinations.

3.1.4. The change of difficult points scoring method of three people and the collective events

Due to the physiological and physical differences between genders, male athletes' ability of performing difficulty movements is obviously higher than female athletes'. The difficulty score of the first eight places competitors in the men's singles and women's singles final in 2012 Gymnastics World Championships showed (see table 7): the total score of the difficulty of the fist eight winners in men's singles was 8.3 points the highest, 7.3 the lowest, 7.89 in average, and as to the females, 7.4 points the highest, 6.8 the lowest, 7.05 in average, and the average score of male's difficulty movements was 0.84 points higher than female athletes. So in order to achieve more excellent performance in collective project, the coach would choose male athletes with better physical quality and congenital conditions to compete in the collective project.

Table 7. Top eight difficulty score comparison between men singles and women singles in 2012 world championships

ranking	one	two	three	four	five	six	seven	eight	The highest	The minimum	average
men's singles	8.3	8.3	8.2	8.1	7.7	7.8	7.4	7.3	8.3	7.3	7.89
women's singles	7.2	6.9	7.1	7.4	7.1	6.8	6.8	7.1	7.4	6.8	7.05

Although the 2009-2012 version rules changed the regulation that difficulty score in the three and six items with female athletes' participation would be divided by the coefficient of 1.9 (no female being divided by 2.0), in 2012 World Aerobics championship, the top four teams in three and six items are still all-male combination, holding an absolute advantage. From table 8 we can see that the number of competition teams with and without female participants was about equal, including, but the average ranking was dramatically different, especially for the three-person items; that only one team of the top eight teams competing in three-person items had female players, only three with female players in the top 16 teams, and only two teams with female players in the top eight teams competing in six-person items, that the lack of gender balance seriously influenced the development of the event. To encourage female competitors to join the collective events of aerobic gymnastics, 2013 new rules change the former difficulty coefficient from 1.9 point to 1.8 to make up for female athletes' strength and technique deficiency. Thus male and female athletes can play fairly.

Table 8. Gender combination in three- and six- person items world in 2012 championships

project	difficulty coefficient	The first eight		The top half		All the participating teams		
		teams	percent	teams	percent	teams	percent	The average rank
TR(male)	2.0	7	87.5	13	81.3	17	53.1	12.3
TR(including women)	1.9	1	12.5	3	18.7	15	46.9	21.3
GR (male)	2.0	6	75.0	6	75.0	8	50.0	7.25
GR(including women)	1.9	2	25.0	2	25.0	8	50.0	9.75

3.2. The development trend of competitive aerobic gymnastics' difficulty under new rules guide

3.2.1. Difficult elements tend to be diversified

In the new competition term, the former 36 base names of difficult elements are reclassified and integrated into 22 family groups, allowing at most 10 different movements from different family groups. This regulation not only limited repetition difficulty movements with similar shape and characteristics, increasing the diversity and beauty of the event, but also enlarged the range of difficult movements. In the 11th World Aerobics Championships, the application rate of difficulty movement was only 24.315%.[6], while the new rules theoretically rose difficulty movement rate to 45.6% (see table 9), leading to more diversified and comprehensive difficulty elements. If removing some family base name groups, which had lower difficulty value and some high level competitions almost not select, (such as Push up group in group A, Horizontal Jump group and Scissors Kick in group C, Split Jump and Kick etc. in group D), the coverage of difficult movements could practically rise to 60% or so, which required athletes to have more comprehensive physical quality and technical level. At the same time, the coaches should learn rules carefully, and try to grasp the spirit of the new rules to avoid reduction of scores due to the repetition of difficulty movements.

Table 9. Comparison between base names in the old and family group names in the new rules

Difficult category	2009-2012 edition base life name number	2013-2016 edition base life group number
Group A	10	5
Group B	6	3
Group C	13	9
Group D	7	5
total	36	22
Difficulty coverage (%)	27.8	45.6

3.2.2. Difficult elements tend to be higher, harder and newer

The application of difficulty movements with 0.8-1.0 point score gradually rose from 20% in the 9th World Aerobics Championships to 48.44% in the 12th. Players all over the world are tending to attach importance to harder movements [1]. The deduction of the value of the original difficulty movements in new rules and the appearance of the new difficulty movements with high value, as well as the rising of minimum standards of movement accomplishment indicated more fierce competition of this event and difficult moves become one of the decisive factors to evaluate an athlete's competitive ability. An excellent athlete must have overall physical quality and super competitive skills to perform perfectly difficulty movements from different groups. The competitive level of athletes also spurs the difficult elements of athletic aerobics toward a higher, more difficult and newer direction.

3.2.3. More attention is paid to difficulty combination in terms of adapting whole sets of difficult elements

According to the rules, proper and effective application of difficult combination will get an increase of 0.1 points,

while improper usage of it would risk discounting the original value of the difficulty movements [7]. The high value of "Combination of difficulty" and temporal "economy" has a very strong attraction, and its unique connection method can fully reflect the technical level and competitive ability of movement [8]. The new rules redefine the meaning of groups difficult, so in this competition term, no deduction would be done for any objective factors like error difficult movements or combination, etc. In order to get better performing achievement, in daily training we should pay more attention to the enhancement of the athletes' physical quality and the competitive ability, creating more difficult combination to get increase in points, providing more developing space for the high level athlete.

The new rules only allowed combination of the elements from group A and group C. From the general movement adaptation rules and the movements selected by the 10 competitors in the single finals in the 2010 World Aerobics Championships (table 10), the number of difficulty movements of complete set from group A and group C is 6-8, and at most 4 difficulty combination can be selected in theory. Players can choose the number of difficult combination according to their own ability, to achieve the combination of hardness and elegance, widening the gap between competitors of different levels.

Table 10. Difficulty group statistics of single items in 2010 World Aerobatics Championships

	IW1	IW2	IW3	IW4	IW5	IM1	IM2	IM3	IM4	IM5	quantity
Group A	2	2	2	2	2	2	3	2	2	3	2-3
Group B	1	2	1	1	1	2	1	1	1	1	1-2
Group C	5	4	5	5	5	4	4	5	4	5	4-5
Group D	2	2	2	2	2	2	2	2	3	1	1-3

3.2.4. Difficulty coefficient further to be lowered to embody fairness in the male-and-female-in-the-same-group competition

The new rules of the FIJ 2013~2016 changed the difficulty score coefficient to 1.8, which, to a certain extent, made up for the disadvantages of female athletes, but it still did not have a significant effect. Take the fifth place winner of six-person event in 2012 World Aerobatics Championship, Romania team 1 (six female), for an example. Its difficulty score was 4.105 points (with coefficient being 1.9), if the coefficient (1.8) of difficulty score in this competition term was adopted, it would be 4.333, with an increase of 0.228 points, and correspondingly ranking to the fourth. But how to adjust the difficulty coefficient to make the male and female athletes play more fairly in the same group competition? According to the difficulty score difference between 38 men's singles players and 52 women's singles players in the 2012 World Aerobatics Championships (table 11), the author extrapolated, respectively from five levels of players of the top 8, top 16, top 24, first 1/2 and all the contestants, that the difficulty coefficient to be less than 1.8 and the average is 1.729. Therefore, to realize the fairness in the male-and-female-in-the-same-group collective aerobics competition, difficulty coefficient should continue to be lowered.

Table 11. Difficulty score statistics of Men's singles, women's singles preliminary competitions in 2012 World Aerobatics Championships

The difficulty points ranking	The men's difficulty(mean)	The women's difficulty(mean)	Gender difference	Presumably the difficulty coefficient
Top 8	8.125	7.063	1.063	1.738
Top 16	7.844	6.894	0.950	1.758
Top 24	7.563	6.663	0.900	1.762
former 1/2 players	7.778	6.615	1.162	1.701
all the contestants	6.811	5.744	1.067	1.687
mean	7.624	6.596	1.028	1.729

Note: 1, according to the difficulty score of the 2012 World Aerobics Championship Men's singles, women's singles event [9]; 2, the difficulty coefficient = women's ingles difficulty score x 2 /men's difficulty score

CONCLUSION

(1) The new rules regulated life difficulty movement to the 22 base of the groups and enlarged the choice scope of difficulty movement, limiting the similar form and characteristics of difficulty elements from occurring repeatedly, and making more comprehensive and diversified difficult elements possible.

(2) The decrease of difficult elements' score and addition of new higher difficult ones in the new rules requires athletes' even stronger physical stamina and higher training skills, extreme difficulty and novelty continue to be the aim of difficult elements.

(3) According to the new rules, in the new cyclical competition, lack of group and reduction of scores is not restricted by objective factors and great attention is paid to difficulty combination in terms of adapting whole sets of

difficult elements. That allows athletes to choose reasonable difficult combination according to his or her ability to fulfill the perfect and harmonious performance by displaying the beautiful and difficult elements.

(4) The new rules revised the score of difficulty coefficient of three people and collective events to1.8, which slightly increased female athletes' competition in the three persons and collective events. The difficulty coefficient has to be further lowered to embody fairness in the male-and-female-in-the-same-group competition.

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