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METROLOGICALLY AND IDEOLOGICALLY CORRECT RANKING SYSTEM OF ATHLETES IN MODERN PENTATHLON

The article deals with the problem of metrological and ideological correctness of the existing system of ranking athletes in modern pentathlon.

The authors have presented an alternative ranking system for the participants of the competition. The proposed ranking system meets the requirements of the ideology of this sport and is metrologically more correct than the officially operating one. The use of the ranking system developed by the authors provides a more even connection between the places occupied by athletes in the types of the program and the final place in the all-around in comparison with the current system in which such types as fencing and the combined relay are clearly dominant.

At present, modern pentathlon is one of the most intensively developing sports in the Republic of Belarus. Belarusian athletes, as a rule, are among the ten strongest athletes in the world. The greatest success was achieved by the representatives of the women's modern pentathlon.

The modern pentathlon has undergone so many changes over the past century that it has actually become a quadrathlon. Competitions in running and shooting were combined into one combined event. Thus, four types remained: fencing, swimming, horseback riding and a combined type.

However, the ideology of this sport remains the same. The winner must be an athlete who is most comprehensively developed in all pentathlon exercises. In accordance with the testament of the founding father of the modern pentathlon, P. Coubertin, this sport should present the world with an ideal, versatile athlete [1].

However, the ranking system of athletes in this sport is rather confusing and not fully substantiated metrologically. The scoring system is used. Moreover, the athlete is awarded points in each type of program according to different rules, which leads to incomparability and non-equivalence of the results (points) scored in the all-around events. In other words, 300 points in fencing is not equivalent to 300 points in swimming, riding, or combined form. The complexity of

their set in various types of all-around is very different. Apparently, no one in the history of this sport has been able to score 300 points in fencing. In horse riding, the best participants score 300 points; in swimming, athletes often score more than 300 points, while in combined form, 600 points are not the limit. For example, at the World Championships in Cairo (2021) and Budapest (2019), the best results of athletes in the types of programs, expressed in points, looked like this (Table 1).

Table 1 – The best results of athletes in types of program, expressed in points, demonstrated by them at the 2021 and 2019 World Championship (men)

World Championship	Types of all-around (points)			
	Fencing	Swimming	Horseback riding	Combined form
Cairo 2021	262	310	300	624
Budapest 2019	258	320	300	654

Such an approach undermines the ideology of the all-around. In addition, from the point of view of metrology, it is impossible to summarize the points scored in this way, since the point is not a unit of measurement and, in connection with the foregoing, is not normalized, not tied to a material standard.

Thus, in modern pentathlon there is a problem of metrological and ideological correctness of the ranking system of athletes, both in each type of program and in the all-around.

The purpose of the study: to develop a metrologically and ideologically correct system for ranking participants in modern pentathlon competitions.

Results of the study and their discussion. If we schematically present a more adequate ranking system for competitors, then it can be the same as in Figure 1.

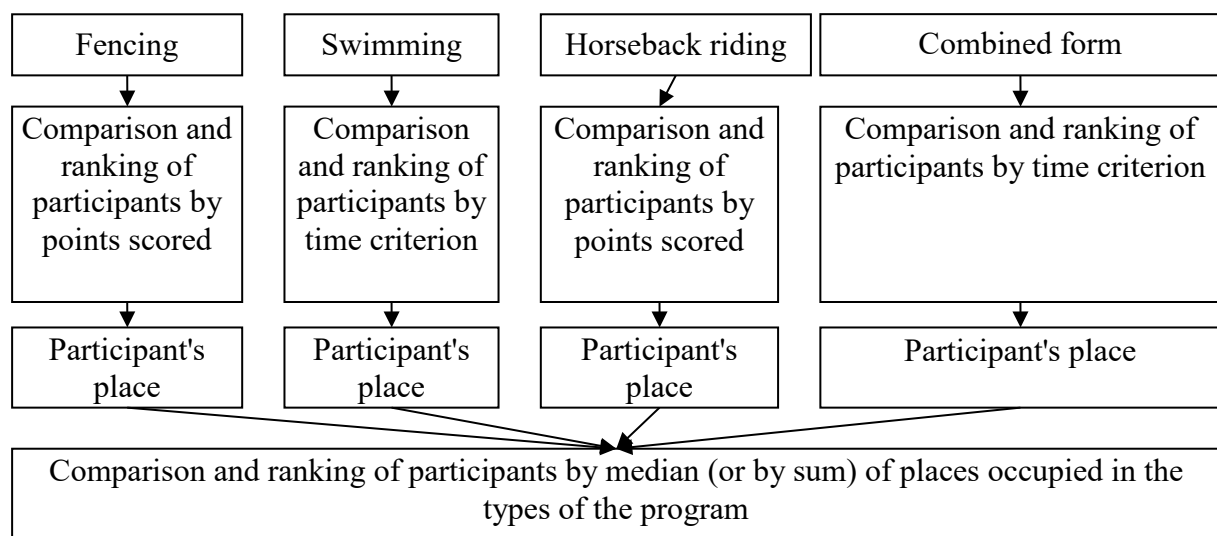


Figure 1 – Proposed ranking system for modern pentathlon competitors

Comparison and ranking of participants in fencing and horseback riding can be carried out according to already existing rules (according to the system of points scored), since in this way it is possible to qualitatively rank the participants and distribute them according to their places (assign ranks). In swimming and combined form, ranking of athletes (assignment of their places) can be done without points according to the result shown (time).

As a result of passing four types of all-around, each athlete takes a place corresponding to his level of preparedness in each of the types of the program (receives ranks of which there are only four). Moreover, it is obvious that, taking into account the fact that the ranks are assigned to athletes in the

same aggregate (the composition of athletes at specific competitions does not generally change), the first place taken by an athlete in swimming can be considered equivalent to the first place taken in fencing, horseback riding or combined form.

Further, the rules of metrology require to calculate the median of the ranks of each athlete and, according to the criterion of the median, rank them finally. We must recall, that an adequate statistical characteristic of the central tendency of the sample, if the measurements were carried out using a rank scale of measurements, is the median, but not the arithmetic mean. The median is a number that divides the sample in half in such a way that half of the sample elements are greater than the median, and the other half is less than the median [3].

However, this requirement conflicts with the ideology of modern pentathlon, which implies the most comprehensive development of athletes in all types of programs. For example, an athlete took the following places in the types of the program (received ranks) 5, 8, 11, 7, the median was 7.5. But the problem is that if he “failed” one type and received ranks 5, 8, 36, 7, then the median would not change. This state of affairs would push athletes to prepare for triathlon, since the value of the median would be influenced by the places occupied in only three of the four types of programs.

Taking into account the fact that the places (ranks) occupied by athletes in the all-around events are to some extent normalized, it is possible to sum up the places and, according to this criterion, carry out the final ranking of the participants.

In order to demonstrate and test our proposed system for ranking participants in modern pentathlon competitions, we used the official results of the 2019 World Championships in Budapest. Table 2 presents the official results of the 2019 World Championships participants and the results of their ranking according to the system we propose.

It is obvious that the system we propose is more in line with the ideology of the modern pentathlon. For example, an athlete, who officially took 4th place in the final protocol, ended up in 18th place according to the new ranking system, since he “failed” the combined event, taking 33rd place among 36 participants. There have been changes in the top three winners. The official champion from France yielded to an athlete from Britain in terms of the total number of places taken. Officially, the third athlete from Korea became fourth, and his place on the podium was taken by an athlete from Hungary, who officially ranked fifth. There are other changes as well. Of course, no one suggests revising the official results of the championship. The table is of purely scientific interest.

Table 2 – Official and adjusted results of the 2019 World Championship participants

Name	Nation	Fencing (place)	Swimming (place)	Horseback riding (place)	Combined form (place)	Total amount of points	Official place	The number of places taken in the types	Place according to the new system
1	2	3	4	5	6	7	8	9	10
Belaud Valentin	FRA	2	17	4	9	1468	1	32	2
Choong Joseph	GBR	6	1	9	15	1453	2	31	1
Jun Woongtae	KOR	8	9	24	4	1452	3	45	4
Lee Jihun	KOR	1	16	33	19	1439	4	69	18
Kasza Robert	HUN	13	8	5	17	1436	5	43	3
Tymoshchenko	UKR	5	33	16	7	1434	6	61	11
Palazkov Ilya	BLR	4	12	32	16	1429	7	64	16
Hamad Eslam	EGY	12	13	20	12	1426	8	57	7
Prades Valentin	FRA	17	21	15	5	1423	9	58	9
Cooke James	GBR	31	2	7	8	1419	10	48	5

End of table 2

1	2	3	4	5	6	7	8	9	10
Marosi Adam	HUN	7	4	19	27	1419	11	57	7
Jung Jinhwa	KOR	3	5	35	18	1418	12	61	11
Demeter Bence	HUN	14	23	1	22	1417	13	60	10
Grycz Marek	CZE	16	3	11	22	1415	14	52	6
Luo shuai	CHN	26	32	12	3	1414	15	73	20
Kinderis Justinas	LTU	10	19	8	28	1411	16	65	17
Tsikhhanau Pavel	BLR	20	25	3	14	1409	17	62	14
Liebig Fabian	GER	28	20	2	11	1404	18	61	11
Zhang linbin	CHN	11	28	26	20	1403	19	85	24
De Luca Riccardo	ITA	9	36	27	23	1398	20	95	30
Elgendy ahmed	EGY	35	7	18	2	1398	21	62	14
Lifanov Alexander	RUS	22	22	14	13	1398	22	71	19
Kalimullin Danil	RUS	18	35	6	26	1396	23	85	24
Vlach Martin	CZE	32	24	34	1	1396	24	91	27
Sukharev Vladisl	KAZ	19	6	25	30	1391	25	80	22
Toolis Thomas	GBR	21	10	13	29	1386	26	73	20
Stasiak Sebastian	POL	25	18	21	25	1380	27	89	26
Carrillo Duilio	MEX	15	29	29	33	1377	28	106	33
Colasanti Daniel	ITA	34	31	22	6	1375	29	93	28
Zvedeniuk Pavlo	UKR	23	15	23	32	1374	30	93	28
Regos Gergely	HUN	36	27	10	10	1367	31	83	23
Dogue Patrick	GER	30	26	17	24	1363	32	97	31
Seo Changwan	KOR	29	14	28	31	1359	33	102	32
Curry Samuel	GBR	33	11	30	35	1342	34	109	34
Staskiewicz Szy	POL	24	34	31	36	1326	35	125	35
DogueMarvin Faly	GER	27	30	36	34	1325	36	127	36

Of interest is also the correlation between the results of athletes in the types of programs and their place in the all-around (Table 3). The calculation of Spearman's rank correlation coefficient showed that with the official ranking system of participants, the closest relationship between the number of points scored in the form of a program and the final place of athletes in the all-around is observed in fencing ($\rho = 0.737$) and combined form ($\rho = 0.533$). The least close relationship is observed in swimming ($\rho = 0.407$) and horseback riding ($\rho = 0.304$). According to the authors, an uneven relationship between the types of pentathlon and the final place was also revealed in the women's modern pentathlon [4, 5, 6]. As for the ranking system of athletes we propose, the value of the rank correlation coefficient between the places occupied by athletes in the types of programs and the final place in the all-around ranges from 0.505 to 0.579. Thus, a more even relationship is observed and none of the species clearly dominates.

Table 3 – Correlation between the results of athletes in the types of programs and the final place in the all-around (taking into account the applied ranking system)

Types of all-around (points/places)	Final place	
	by points scored	according to the number of places taken
Fencing	0,737	0,505
Swimming	0,407	0,579
Horseback riding	0,304	0,569
Combined form	0,533	0,543
All ρ values are statistically significant ($p < 0.05$)		

Conclusion. Thus, our proposed ranking system for modern pentathlon competition participants, in general, meets the requirements of the ideology of this sport and is metrologically more correct than the official one.

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STRUCTURAL-CONTENT MODEL OF COMPETITIVE CULTURE OF ATHLETES, SPECIALIZING IN MODERN PENTATHLON

In the article, within the framework of the activity approach, a theoretical model of the competitive culture of athletes specializing in modern pentathlon is developed and presented, its constituent components and elements are introduced. The goal and systemic tasks of the competitive training of the pentathlete have been determined. The structural elements of the thinking activity and executive components of the athlete's competitive culture are introduced. The following is presented: structural-functional model of the need-motivational sphere of the competitive culture of the pentathlete; structural-content model of the competitive knowledge of the pentathlete; the composition of the competitive skills of the pentathlete; the structure of the pentathlete's physical fitness.

At present, modern pentathlon is one of the most intensively developing applied types of sports all-around in the Republic of Belarus. Belarusian athletes are usually among the ten strongest athletes in the world. The greatest success was achieved by the representatives of the women's modern pentathlon. Further maintenance of the reputation in the post-doping era is possible through the development of theoretical models of competitive culture, competitive activity, competitive training, adequate diagnostic tools, development of pedagogical principles, means and methods of training athletes within the framework of activity, systemic and cultural approaches. In other words, by connecting a previously little demanded pedagogical resource, the possibilities of which are huge.

Today it is obvious that in order to achieve a high result in modern pentathlon, a rational combination of all elements of the athlete's competitive culture is necessary [1; 2; 3].