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Published online Jan 2021

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**To cite this article:** Roberto Roklicer, Milorad Dokmanac, David G. Curby, Nemanja Lakicevic, Tatjana Trivic, Mario Baic and Patrik Drid (2020) PERFORMANCE DATA ANALYSIS OF GRECO-ROMAN WRESTLING MATCHES OF THE 2019 EUROPEAN CHAMPIONSHIPS. International Journal of Wrestling Science, 10 (2), 1-10.



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# PERFORMANCE DATA ANALYSIS OF GRECO-ROMAN WRESTLING MATCHES OF THE 2019 EUROPEAN CHAMPIONSHIPS

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## ABSTRACT

Wrestling is recognized as a vigorous, intermittent and weight categorized combat sport. For the purpose of revealing essential information for development of sport-specific preparation of wrestlers, technical-tactical and physiological demands analyses of wrestling matches are critical for elite level athletes. The aim of this study was to present analyzed technical-tactical scoring actions in Greco-Roman wrestling in the 2019 Senior European Championship via a novel *Performance Data Analysis*. Results of this study indicated the prevalence of points scored from standing position compared to parterre actions. Additionally, higher percentage of total points scored were achieved due to technical points in comparison with other points scored, 71.37% vs 28.63%, respectively. Implementing *Performance Data Analysis* could facilitate the understanding and following of a wrestling match. Furthermore, it could help coaching staff to obtain the relevant wrestling-specific data, and that way, to help athletes getting prepared for upcoming competitions.

**Keywords:** elite athletes; performance analysis;

## INTRODUCTION

Wrestling is widely recognized as one of the oldest sports in human history, and as such it was performed within the original events in the ancient Olympic Games (Nilsson et al., 2002). Although the form of wrestling changed over time, it is still one of the most prominent combat sports in modern Olympic Games. Currently, two styles of wrestling are included in the Olympics. Greco-Roman style, which allows strictly upper body techniques, meaning holds below the waist are forbidden, and is practiced only by men. The second is freestyle wrestling where athletes are allowed to use lower extremity techniques and trips which is practiced by both men and women across the world (Horswill, 1992; García-Pallarés et al., 2011). Wrestling is an individual combat sport where athletes are divided in weight-categories with an aim to equalize the physical characteristics during competition, thus trying to highlight their technical and psychological skills as a crucial component of performance (García-Pallarés et al., 2011).

In many sports, activity patterns are intermittent by its nature (Glaister, 2005). Wrestling is characterized as a high-intensity intermittent combat sport (Barbas et al., 2011), containing myriad of various actions and techniques which were examined in earlier studies (Cipriano, 1993; Atan & İmamoğlu, 2005; López-González & Miarka, 2013; González, 2014; Tünnemann, 2016; Tünnemann & Curby, 2016). Due to the nature of wrestling, physical demands include explosive strength, aerobic endurance, and anaerobic capabilities in terms of achieving competitive success (Demirkan et al., 2015).

Building an elite wrestler is a complex and long-lasting process (Baić et al., 2014). Since wrestling is characterized as vigorous physical activity and sport, meticulous physical, psychological and emotional preparation of wrestlers is required (Yoon, 2002). To compete in the finals of the biggest competitions, elite wrestlers usually have to go through 5–6 qualifying matches (Gierczuk et al., 2018), which makes such activity very demanding from a physiological standpoint. Therefore, the ability of an athlete to fully recover between two matches might be crucial not only for performance but injury prevention as well (Barbas et al., 2011). Physical dominance and physical control over the opponent are considered to be the main objective among wrestlers in a competitive setting (Chaabene et al., 2017). Furthermore, quick and explosive maneuvers are related to wrestlers' power and ability to gain control of the opponent (Lansky, 1999).

Due to the frequent modification of rules proposed by UWW (United World Wrestling), technical and tactical adjustment of coaches and athletes are of great importance in terms of competitive success (Lopez-Gonzales, 2014). For the purpose of revealing essential information for development of sport-specific preparation of

wrestlers, technical-tactical and physiological demands analyses of wrestling matches are critical for elite level athletes (Miarka, 2016).

Most sports have taken advantage of modern technology to obtain important information about the sport specifics. Basketball (Suárez-Cadenas et al., 2016), soccer (Palucci et al., 2019), American football and tennis (Tiwisina & Külpmann, 2019) made the greatest success in the IT monitoring of sporting event.

At this moment, wrestling significantly falls behind in the information tracking of wrestling competitions. Therefore, the purpose of this study is to introduce an innovative approach to obtain wrestling-related data during a match. We analyzed technical-tactical scoring actions in Greco-Roman wrestling in the 2019 Senior European Championship via the novel *Performance Data Analysis*.

## METHODS

### Participants

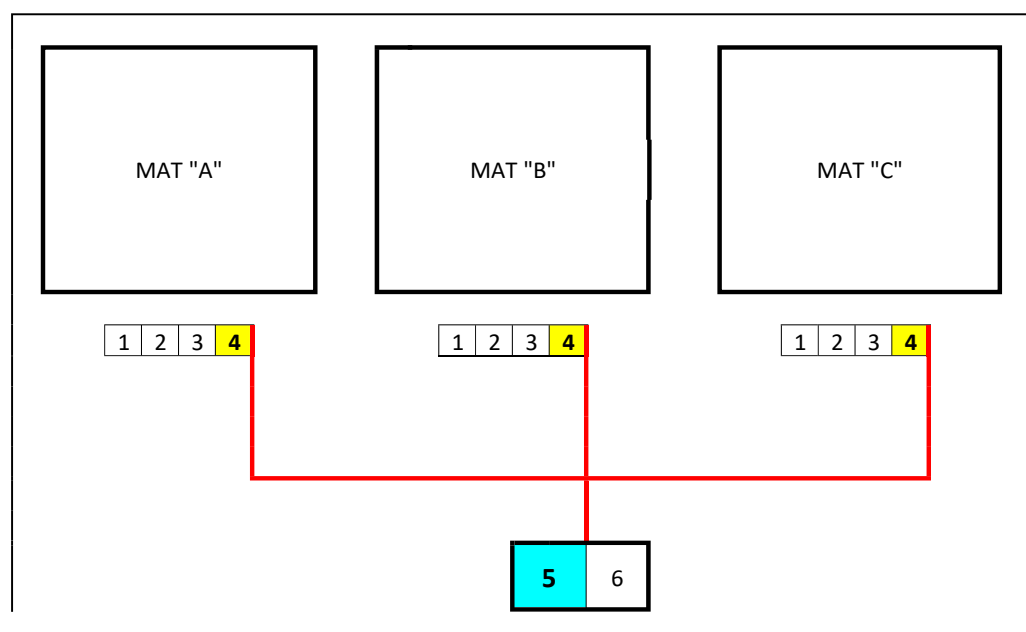
European wrestling championships for senior-age competitors was held in Bucharest, Romania (08-14.04.2019.) both for Greco-Roman and freestyle wrestling. A two-day competition of Greco-Roman style wrestling included a total of 292 wrestlers from 34 different countries that competed in the championship. Since the entire sample represented national teams, all participants were considered elite athletes. Accordingly, athletes competing in all of the ten weight classes were observed and analyzed (55 kg, 60 kg, 63 kg, 67 kg, 72 kg, 77 kg, 82 kg, 87 kg, 97 kg and 130 kg). Consequently, each wrestling match starting from qualifying matches to the finals was included in Performance Data Analysis observation.

### Performance Data Analysis

Data was analyzed on several levels in which we explored: weight categories data, total number of matches, medal matches (1<sup>st</sup> and 3<sup>rd</sup> place), scoring data, executed techniques data, technical and other points scored, standing position and parterre scored points. During the championship, the Technical Commission UWW and the Scientific Commission of UWW had to standardize the variables with the exact name of the wrestling techniques that were analyzed in the software system. It was necessary for UWW to prepare the instruction (written and video) through its expertise that clarified how and in what way these qualitative statistics of big wrestling competitions are going to be performed.

### Overview of mode application qualitative statistics in wrestling competitions

For the needs of the new monitoring system of the wrestling match, it was essential to provide wrestling experts (coaches) who entered relevant data into computer in real time. All computers had to be networked and they used all data from the Arena system. In a case of a large number of points in a single match and in a case of a dilemma involving the wrestling technique, the supervisor in the secretariat has examined the video and made corrections in case an expert near to the mat has made a mistake.



**Figure 1.** Application of qualitative analysis on wrestling competitions  
1 = Video operator; 2 = Mat chairman; 3 = Scoreboard operator; 4 = Experts for technical analysis of matches; 5 = Supervisor - experts for technical analysis of matches; 6 = Arena - system for generating and processing the data.

For the purpose of implementing this monitoring system in wrestling competitions, UWW prepared a software, based on all given data that was automatically generated. Based on all given information, after completing the wrestling competition in this wrestling style, within 5 minutes we have prepared qualitative statistical analysis. This analysis was carried out without any connection to the Arena system, in such a way that, after the competition, videos were examined and recorded all performed wrestling techniques and duration of the match. However, in this case, errors in manual input and processing of data may occur, especially in the analysis of all segments of the matches.

## RESULTS

**Analysis of all matches** Table 1 demonstrates the overall number of points and percentage scored in standing and parterre position. It can be observed that more points were scored in standing compared to parterre position, 62.08% vs 37.92 %, respectively. In terms of standing position actions, the most of the points have been scored due to passivity, take-downs and hip turning throws, 18.82%, 14.11% and 7.40%, respectively. On the other hand, the most commonly used technique in parterre position was gut wrench, following lifts and counter attacks, 20.08%, 9.47% and 3.96% respectively.

**Table 1.** Percentage and total number of points scored in all matches

	Wrestling techniques	Points	%
<b>Standing position</b>			
1	S-passivity	328	18.82
2	S-take down	246	14.11
3	S-hip turning throw	129	7.40
4	S-forward bending throw	95	5.45
5	S-throw suplex	89	5.11
6	S-push out	76	4.36
7	S-counter	59	3.38
8	S-challenge	24	1.38
9	S-caution	20	1.15
10	S-negative Wrestling	16	0.92
Total =		1082	62.08
<b>Parterre position</b>			
1	P-gut wrench	350	20.08
2	P-lifts	165	9.47
3	P-counter	69	3.96
4	P-turn over	42	2.41
5	P-caution	22	1.26
6	P-challenge	13	0.75
Total =		661	37.92
All total =		1.743	100.00

Table 2 shows the percentage of points being scored as technical points (points achieved out of an action - execution of wrestling technique) and other points - which are not related to performance of wrestling technique. Results demonstrate the prevalence of technical points scored related to other points, 71.37% vs 28.63%, respectively.

**Table 2.** Percentage of points scored - divided by technical and other points

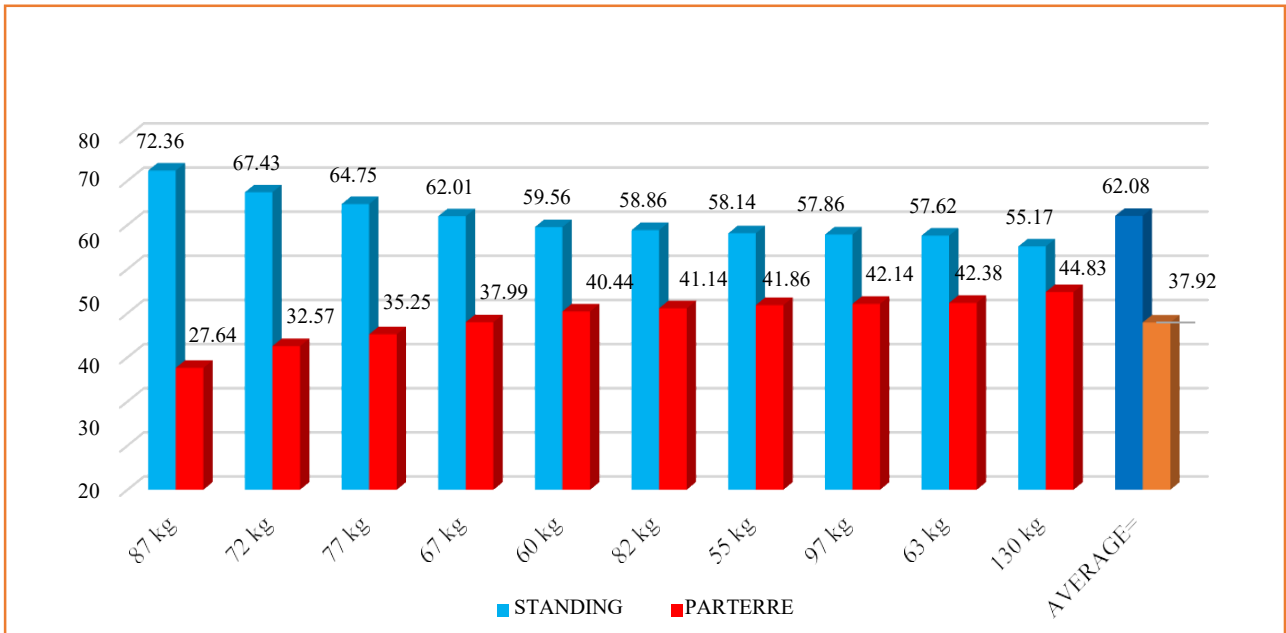
	Wrestling techniques	%
<b>Technical points</b>		
1	P-gut wrench	20.08
2	S-take down	14.11
3	P-lifts	9.47
4	S-hip turning throw	7.40
5	S-forward bending throw	5.45
6	S-throw suplex	5.11
7	P-counter	3.96
8	S-counter	3.38
9	P-turn over	2.41
Total technical points =		71.37%
<b>Other points</b>		
1	S-passivity	18.82
2	S-push out	4.36
3	S-challenge	1.38
4	P-caution	1.26
5	S-caution	1.15
6	S-negative Wrestling	0.92
7	P-challenge	0.75
Total other points =		28.63%
All total =		100.00

S – standing position, P – parterre position

Data regarding total points scored and percentages across each of ten categories is visible in table 3. This table provides details of most frequently executed techniques both in standing and parterre position in all Greco-Roman style matches observed.

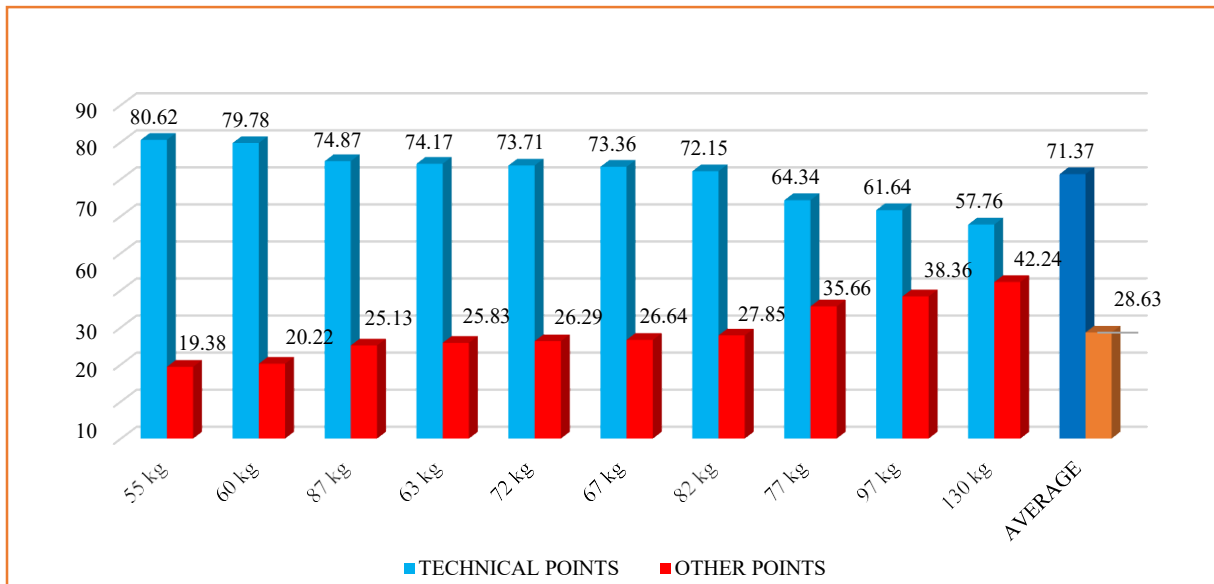
**Table 3.** Total scored points per weight category according to standing and parterre position

WRESTLING TECHNIQUES	55 kg		60 kg		63 kg		67 kg		72 kg		77 kg		82 kg		87 kg		97 kg Pts		130 kg		
	Pts	%	Pts	%	Pts	%	Pts	%	Pts	%	Pts	%	Pts	%	Pts	%	Pts	%	Pts	%	
<b>Standing position</b>																					
1	S-take down	24	18.60	40	21.86	24	15.89	40	17.47	4	2.29	52	21.31	29	18.35	38	19.10	45	28.30	36	31.03
2	S-passivity	15	11.63	23	12.57	21	13.91	28	12.23	20	11.43	34	13.93	18	11.39	36	18.09	22	13.84	12	10.34
3	S-hip turning throw	10	7.75	16	8.74	12	7.95	26	11.35	21	12.00	19	7.79	14	8.86	21	10.55	6	3.77	4	3.45
4	S-forward bending throw	8	6.20	10	5.46	10	6.62	16	6.99	28	16.00	13	5.33	10	6.33	16	8.04	6	3.77	4	3.45
5	S-throw suplex	6	4.65	9	4.92	8	5.30	16	6.99	2	1.14	12	4.92	10	6.33	13	6.53	5	3.14	3	2.59
6	S-push out	5	3.88	6	3.28	4	2.65	6	2.62	2	1.14	10	4.10	7	4.43	10	5.03	4	2.52	2	1.72
7	S-counter	2	1.55	4	2.19	4	2.65	4	1.75	31	17.71	7	2.87	2	1.27	8	4.02	4	2.52	2	1.72
8	S-negative Wrestling	2	1.55	1	0.55	2	1.32	4	1.75	1	0.57	6	2.46	2	1.27	2	1.01	0	0.00	1	0.86
9	S-caution	2	1.55	0	0.00	2	1.32	2	0.87	9	5.14	5	2.05	1	0.63	0	0.00	0	0.00	0	0.00
10	S-challenge	1	0.78	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Total standing position =		75	58.14	109	59.56	87	57.62	142	62.01	118	67.43	158	64.75	93	58.86	144	72.36	92	57.86	64	55.17
<b>Parterre position</b>																					
1	P-gut wrench	34	26.36	38	20.77	42	27.81	50	21.83	26	14.86	32	13.11	26	16.46	32	16.08	32	20.13	44	37.93
2	P-lifts	14	10.85	20	10.93	12	7.95	13	5.68	18	10.29	32	13.11	24	15.19	10	5.03	26	16.35	4	3.45
3	P-counter	6	4.65	10	5.46	6	3.97	9	3.93	6	3.43	11	4.51	8	5.06	7	3.52	6	3.77	2	1.72
4	P-turn over	0	0.00	2	1.09	4	2.65	8	3.49	4	2.29	5	2.05	4	2.53	4	2.01	2	1.26	2	1.72
5	P-challenge	0	0.00	2	1.09	0	0.00	6	2.62	1	0.57	4	1.64	2	1.27	2	1.01	1	0.63	0	0.00
6	P-caution	0	0.00	2	1.09	0	0.00	1	0.44	2	1.14	2	0.82	1	0.63	0	0.00	0	0.00	0	0.00
Total parterre position =		54	41.86	74	40.44	64	42.38	87	37.99	57	32.57	86	35.25	65	41.14	55	27.64	67	42.14	52	44.83
All total =		129	100.00	183	100.00	151	100.00	229	100.00	175	100.00	244	100.00	158	100.00	199	100.00	159	100.00	116	100.00
Time(s) =		57.58		105.00		79.79		147.36		101.96		179.46		112.85		146.91		152.78		121.01	
WQ/min =		2.24		1.74		1.89		1.55		1.72		1.36		1.40		1.35		1.04		0.96	



**Figure 2.** Percentage of total points scored based on standing and parterre actions according to weight category

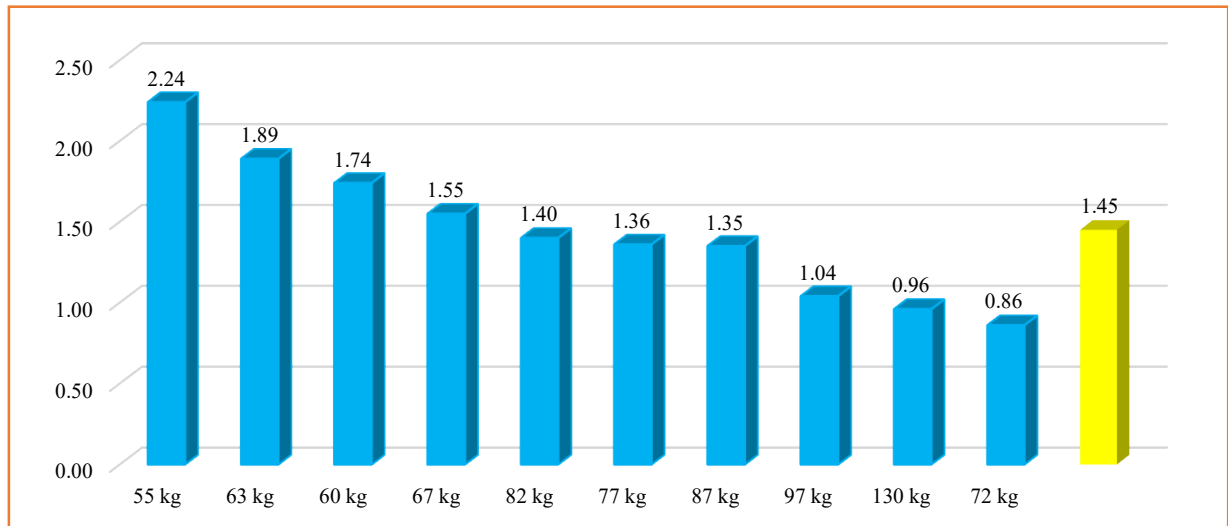
Relation of standing and parterre techniques during entire championship is depicted in Figure 2. The highest percentage of standing position points was scored by the 87 kg weight category while the least percentage was demonstrated by the heavyweight (130 kg) category wrestlers, although compared to other weight categories, they have scored the highest percent of points performing parterre techniques.



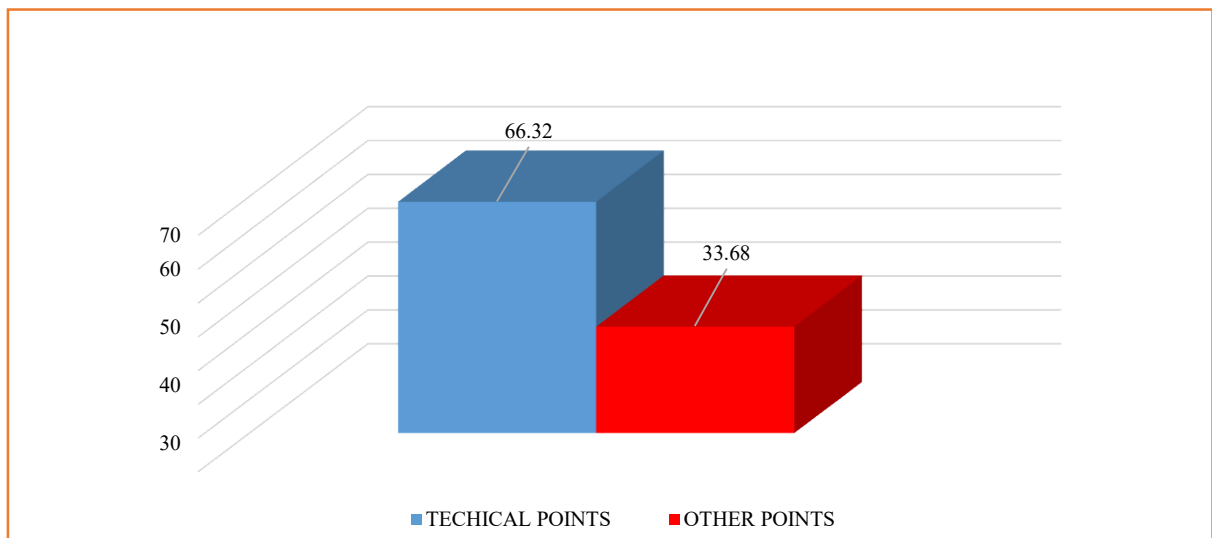
**Figure 3.** Percentage of total points scored based on technical and other points according to weight category

Relation of technical and other points scored during entire championship is depicted in figure 3. The least percentage of technical points was scored by heavyweight (130kg) wrestlers, whereas, at the same time these category athletes won the highest percentage of other points. On the other hand, the lightest weight category (55kg) scored the highest percentage of technical points with the least other points scored compared to other categories.

Figure 4 presents the mean number of points scored per minute for all categories. Apparently, the lightest category wrestlers seem to be the most active in terms of scoring points during the match. Generally, it can be noted that as the weight category increases the number of points scored per minute drops (with an exception of 72 kg weight class). Mean value of points scored per minute for the entire championship was 1.45.



**Figure 4.** Mean value of total points scored per minute according to weight category (WQ/min)



**Figure 5.** Relation of technical points and other points scored during the final matches. Values are expressed as percentages (%)



### **Analyses of medal matches (1st and 3rd place matches)**

This subsection presents analysis of final matches and thus provide useful data regarding techniques performed in finals.

**Table 4.** Percentage and total number of points scored in medal matches

	Wrestling Techniques	No. Points	% Final Match.
<b>Standing position</b>			
1	S-passivity	46	24.60
2	S-take down	28	14.97
3	S-throw suplex	16	8.56
4	S-forward bending throw	12	6.42
5	S-push out	10	5.35
6	S-hip turning throw	6	3.21
7	S-counter	5	2.67
8	S-challenge	3	1.60
9	S-negative Wrestling	2	1.07
10	S-caution	0	0.00
Total standing =		128	68.45
<b>Parterre position</b>			
1	P-gut wrench	36	19.25
2	P-counter	9	4.81
3	P-lifts	6	3.21
4	P-turn over	6	3.21
5	P-caution	2	1.07
6	P-challenge	0	0.00
Total parterre =		59	31.55
All total =		187	100.00

S – standing position, P – parterre position

It was evident that the number of points scored in a standing position is more than twice as high compared to scored points in parterre position. When those values are converted to a percentage, values are 68.45% vs 31.55% in favor of standing position points scored (Table 4). It was notable that there is a prevalence of technical points over other points achieved during the finals (1<sup>st</sup> and 3<sup>rd</sup> place matches), 66.32% vs 33.68%, respectively (Figure 5). The mean value of total points scored per minute in medal matches was 1.14.

### **DISCUSSION**

The current official Bulletin from wrestling competitions contains only numerical data of the winning points, classification points and the duration of the fight. Based on these data it is not possible to make any quality statistical analysis of the important information regarding wrestling competition. For the reasons mentioned above, a unified monitoring system for important wrestling competitions is proposed with an aim to make a performance data analysis of various parameters after the completion of the wrestling competition. A special emphasis was placed on the analysis of points achieved on the basis of the performed wrestling techniques (Technical Points - TP), in relation to the number of points achieved which are not the result of performing wrestling techniques (Other Points - OP). Another important analysis is the number of points in the standing position in relation to the number of points in the parterre position. Significant data are also the number of points made in one minute of the match (WQ / min).

The goal of this study was to provide sport-specific parameters observing the European Greco-Roman wrestling championship with an emphasis to demonstrate data drawn from final matches and total number of matches. Despite the presence of large variety of throws in Greco-Roman wrestling, the most points achieved in standing position seems to occur due to one athletes' passivity. The results from the final matches (1<sup>st</sup> and 3<sup>rd</sup> place) are in line with total matches regarding the most points scored from standing position. Most likely, this appeared along with Greco-Roman wrestling regulation changes. This type of wrestling, caused by modification of rules, is often more suitable for wrestlers that are physically better prepared and are capable of performing a super high intensity during the battle. Take downs were the second most common way to score points from standing position. In terms of parterre actions, the gut wrench technique dominated in comparison to other ones, simultaneously presenting the technique by which the largest number of points was scored during entire tournament. It is notable that percentage of technical points scored exceeded the number of other points, meaning that wrestlers most commonly performed a technique in order to score. The most frequently used standing and parterre position wrestling techniques refer to all ten weight categories.

In order to be able to apply the new performance data analysis, it is necessary to develop software based on which data will be automatically generated. This software will enable us to conduct quality analysis on bases (analysis of all matches, analysis of weight categories, analysis by nation, analysis of medal matches and analysis the best wrestlers on the championship). Data obtained with our study could be of great help to sport scientists, coaches and athletes.

The scientific communities are concerned about the understanding the scoring actions in Greco-Roman wrestling. With an aim to improve the monitoring of prestigious championships (Olympics Games, Continental Games, World Championships, Continental Championships, qualifying tournaments for the Olympic Games and tournaments from the Ranking Series), wrestling associations around the world should consider implementing *Performance Data Analysis* in competitions. Consequently, it could facilitate the understanding and following of a wrestling match. By employing *Performance Data Analysis* more extensive range of data can be provided. However, this study presented only small portion of those which are considered to be of interest for coaches and sport scientists.

## CONCLUSIONS

It is of the greatest value to have quality statistical monitoring of wrestling competitions. This method is important for coaches because after each big competition, they can have a clearer overview of all wrestling techniques. Thereby, the coaching staff will be able to work on technical and tactical improvement of wrestlers for the upcoming important competitions. Engagement of this explorative approach of statistical monitoring could have a broader application. By adopting *Performance Data Analysis* in prestigious championships, easier analysis by Technical Commission of the United World Wrestling (UWW) is enabled. Furthermore, this favors of preparation of quality proposals for amendments to the wrestling rules. All analyzed data prepared this way will significantly help by rapidly obtaining comprehensive sport-specific information.

## Disclosure statement

No potential conflict of interest was reported by the authors.

## Acknowledgments

Supported by the Serbian Ministry of Education, Science and Technological Development (179011) and Provincial Secretariat for Higher Education and Scientific Research (142-451-2094).

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