ORIGINAL ARTICLE

Differences between technical activities used by male and female wrestlers competing in Seniors European Wrestling Championships (Roma, 10-16 February 2020)

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A Study Design
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Abstract

Background and Study Aim: Many researchers indicate diversity of fighters who practice combat sports in the field of gender-segregation. The aim of study is knowledge about anticipated differences in technical activities which were used during wrestling match, between men and women.

Material and Methods: The study included process of sports competition during Seniors European Wrestling Championship (Rome, 10-16 February 2020), in female and male free-style wrestling. Female wrestling competition included 126 wrestlers and 149 wrestling bouts, while free-style wrestling competition included 177 wrestlers and 215 duels. Replaying and stopping of fights was possible thanks to digital recordings.

Results: Studies which were carried out indicate a diversity in a way of conducting a bout in relation to a wrestler's gender. Regarding the settling a match, winning by points advantage in a regular match time dominates both in female wrestling and male free-style wrestling. However, women settled the match by foul more frequently than men (20% among women, 6% among men, $p<0.0001$). A diversity of applied technical actions in both standing and horizontal positions was also observed.

Conclusions: According to the obtained results, wrestlers have use specific techniques more frequently in different sex and weight categories. Therefore, coaches could create a specific training programme for athletes.

Key words: combat sports • Olympic wrestling • wrestling match round

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Olympic wrestling – refers to Greco-Roman style, freestyle and women's wrestling.

Match – noun **1,** a contest between opponents, especially a sporting contest **2,** somebody or something capable of competing equally with another person or thing [31].

Parterre position – in wrestling jargon it is a fight in a **horizontal position** (**posture**), the opposite is a fight in a **vertical posture** (or **standing position**).

Technique – noun a way of performing an action [31].

Foul – noun an illegal action against an opposing player, or an action that breaks the rules of a sport ■ verb to act illegally against an opposing player, or break a rule of a sport [31].

INTRODUCTION

Multifactoriality and high versatility of requirements for various aspects of body's ability characterizes a wrestling bout. Therefore, equal development of all physical features forms the basis for obtaining an appropriately high level of athletic level [1-5].

Wrestling match is characterized by short-term, intense, intermittent effort, which lasts 6 minutes in total for seniors group (1 match = 2 × 3-minute round), whereby a necessity of having 4-5 matches a day during a wrestling tournament is an additional element of that effort [6]. During such effort, blood can elevate lactate concentrations in excess of 15 mmol/L and sometimes reach nearly 20 mmol/L. In comparison, maximal treadmill tests may raise lactate levels to around 10 mmol/L [7, 8].

In research, effort capacity is indicated as one of main factors which characterize high level athletes. Anaerobic power is one of those elements in free-style wrestling, which may play a key role in a final result of sports competition [9, 10].

Modern wrestling has a tendency to increase an intensity of wrestling bouts, which raises importance of special endurance determining sports level. High number of actions (activities) connected with fast overcoming of opponent's resistance, increasing it, an ability to surprise enemy and to forcing him to react in short period of time requires very high level of endurance capacities [11-13].

Many researchers indicates a diversity of wrestlers in the field of weight categories. This research demonstrate that in absolute values, heavier weight categories obtain higher values than lighter categories, but in relation to body weight, differences between examined groups were irrelevant [14, 15]. These findings often relate to intragroup study including chosen competition, namely Greco-Roman wrestling, free-style wrestling and female wrestling [16-18]. Less frequently, carried out studies include comparison between individual styles of wrestling bout [19].

Comparative study between women and men carried out in the area of wrestling concerned mainly on body structure, body composition, physiological factors [11, 12, 14, 20]. Conducting a research in the field of sports training conditions of women and men is a reference to a research which is carried out in a similar combat sports discipline – judo [21-23].

Free-style wrestling, as well as female wrestling are identical in terms of sports regulations, Both in female wrestling and in male free-style wrestling using legs to perform technical activities and executing actions on opponent's legs is allowed. Therefore, resource of technical activities, possibility to use techniques in order to gain advantage and achieving victory is identical for both men and women. Moreover, tactical preparation for match versus high level athletes can be similar for both genders.

In both competitions, rivalry is being played in 10 weight categories (6 weight categories in Olympic tournament competition and 4 weight categories beside the tournament). Due to body weight differences between men and women, different weight categories for male and female wrestlers were introduced. In female wrestling the following weight categories breakdown is considered: up to 50 kg, 53 kg, up to 57 kg, up to 62 kg, up to 68 kg, up to 76 kg – Olympic tournament categories, and: up to 55 kg, up to 59 kg, up to 65 kg, up to 72 kg – categories beside Olympic tournament [24].

Wrestling bout, interactions between fighters, affect match tactic, consisting of simple and complex movement activities: holds, defences, counter grips. Activities used by opponent during bout complicate executing an action, and force athlete to combine wrestling holds and creating various combinations. During long-standing trainings and courses wrestlers absorb their favourite techniques. However, higher number of mastered holds increases the number of ways in which you can conduct a bout, and hence it increases chances of winning. One of fundamental technical activities, used in free-style and female wrestling is leg attack [25-27]. Ito et al [28] point out differences in preparing and performing such type of technical elements between men and women.

Nevertheless, studies which search for direct comparisons of ways of settling matches or type of used technical activities during main tournament competitions based on the gender.

The aim of study is knowledge about anticipated differences in technical activities which were used during wrestling match, between men and women.

MATERIAL AND METHODS

Research material

The study included process of sports competition during Seniors European Wrestling Championship (Rome, 10-16 February 2020), in female and male free-style wrestling. Female wrestling competition included 126 wrestlers and 149 wrestling bouts, while free-style wrestling competition included 177 wrestlers and 215 duels. Source material constituted digital recordings of bouts shared by portal www.unitedworldwrestling,com. Number of athletes who competed in particular weight categories and number of played bouts can be found in Table 1. Due to differences in weight categories in female (from 50 kg to 76 kg) and male (from 57 kg to 125 kg) competition, and taking into account that in both competitions there are 10 weight categories, further categories were adopted as comparative categories for research purposes (Table 1).

Research methods

Video clips of the matches were obtained from the United World Wrestling (UWW) official web site. The video clips were downloaded to a PC as MP4 files using the screen recording function, We clipped and saved the entire match from the original video. For playback of the video, we used a Quick time player (Inc, California, U,S,A). For the match in each video clip, our analysis utilized the following criteria: type of won victory; a bout may be won: by "fall"; by technical superiority; following a forfeit; by a disqualification; by points (by having at least 1 point more after addition of the two periods) [24].

Technical activities in standing and horizontal positions.

Chosen technical activities used in standing position:

- **leg attack** – to the wrestler who applies a correct leg attack while standing on the mat and finishing in the "parterre" position with three points of contact;
- **throw** – any move in which a wrestler lifts the opponent from the mat, then brings him back down to danger position or "parterre" position;
- **take dawn** – when a wrestler takes the opponent to the mat from the neutral position to the "parterre" position with three points of contact;
- **activity time** – when wrestler designated as passive must take score points during a 30 second activity period;
- **step out** – the wrestler whose opponent goes in the protection zone with one entire foot (in standing position) [24].

Chosen technical activities used in parterre position:

- **turn over** – the attacking wrestler whose opponent rolls onto his shoulders;
- **gut wrench** – the wrestler who executes a hold that places his opponent's back at an angle of less than 90 degrees, including when his opponent is on one or two outstretched arms,
- **caution** – Fleeing a hold occurs when the defending wrestler openly refuses contact in order to prevent his opponent from executing or initiating a hold [24].

Table 1. Breakdown of weight categories, number of bouts and athletes in particular weight categories of analysed tournaments.

Female wrestling			Male free style wrestling		
weight category	number of		weight category	number of	
	bouts	athletes		bouts	athletes
50 kg	15	13	**57 kg**	21	17
53 kg	22	17	**61 kg**	17	14
55 kg	11	10	**65 kg**	24	21
57 kg	14	12	**70 kg**	23	18
59 kg	13	11	**74 kg**	25	18
62 kg	15	13	**79 kg**	21	18
65 kg	14	12	**86 kg**	26	22
68 kg	15	13	**92 kg**	15	13
72 kg	9	8	**97 kg**	22	18
76 kg	21	17	**125 kg**	21	18

- Point value of executed technical activities (1, 2 or 4 points) [24].

An important premise of our research is the fact that first author has a great deal of experience in both the participation and coaching of wrestling. Therefore, we were able to use expert method in order to evaluate and compare technical activities which were used in both female wrestling and free style wrestling groups.

Statistical analysis

Data were processed using IBM SPSS statistical software® version 22 for Windows (New York, USA). Descriptive, combat resolution structures are presented as mean and standard deviation (±). For categorical data, results were expressed as absolute numbers (n) and percentages (%) we used comparison of proportions test. Fisher-Irwin tests for small groups Chi-square analysis was used to investigate the relationship between the type of victory way and variables of interest, such as weight categories. One-way analysis of variance repeated measurements Friedman's rank (Friedman's ANOVA) was used to comparison of the average number of points scored in individual weight categories (1 point, 2 points, 4 points) by the nonparametric Wilcoxon pair order test consider to Bonferroni method for post-hoc correction. Significance was set a priori at least $p \leq 0.05$.

RESULTS

Comparison of completed bouts

In combat sports, ways of settling the bouts are largely depending on diversification of athletes' sports level. In both examined groups (Table 2), the dominant way of settling the bout was victory by technical superiority, both in female wrestling (56.38%) and male free style wrestling (67.44%). Settling the bout by foul was significantly more

Table 2. Distribution of settlements of female and male bouts.

Variable	Results [%]			
	Foul	Advantage	For points	Total
female wrestling	20.13	23.49	56.38	100.00
male free style wrestling	6.51	26.05	67.44	100.00
difference	13.62****	2.56	11.06*	
significance level (p)	0.0001	0.5797	0.0319	

*p<0.05; ****p<0.0001

Table 3. Distribution of settlements of female and male bouts in particular weight categories.

Female wrestling (results in %)				total	Male free style wrestling (results in %)				total
weight category	foul	advantage	for points		weight category	foul	advantage	for points	
50 kg	20.00	20.00	60.00	100	**57 kg**	14.29	19.05	66.67	100
53 kg	22.73	18.18	59.09	100	**61 kg**	0.00	29.41	70.59	100
55 kg	18.18	36.36	45.45	100	**65 kg**	8.33	29.17	62.50	100
57 kg	**28.57***	14.29	57.14	100	**70 kg**	**4.35***	30.43	65.22	100
59 kg	30.77	30.77	38.46	100	**74 kg**	16.00	32.00	52.00	100
62 kg	13.33	26.67	60.00	100	**79 kg**	0.00	19.05	80.95	100
65 kg	14.29	21.43	64.29	100	**86 kg**	3.85	15.38	80.77	100
68 kg	6.67	33.33	60.00	100	**92 kg**	6.67	46.67	46.67	100
72 kg	**33.33***	11.11	55.56	100	**97 kg**	**4.55***	9.09	86.36	100
76 kg	19.05	23.81	57.14	100	**125 kg**	4.76	38.10	57.14	100

*p<0.05

prevalent in female wrestling (20.13%) than in male free style wrestling (6.51%), whereas settling the bout by technical superiority was more frequently apparent in male free style wrestling (male free style 67.44%, female wrestling 56.38%). In particular weight categories (Table 3), there were no statistically significant differences noted in the way of settling the match between female wrestling and male wrestling, apart from 57kg (28.57%), 70kg weight category (4.35%) and 72kg (33.33%), 97kg weight category (4.55%), where statistically significant differences were noted, in settling the bout by foul.

Comparison of technical activities

Wrestling bout can be conducted in two positions: standing position and horizontal position. In both examined groups, standing position was the most dominant position during the fight, in which athletes performed technical activities which resulted in gaining points. In female wrestling group, athletes gained 6.08±1.23 points on average during the bout (Table 4), while for male free style wrestling group, the average value was 6.77 ±1.86. This dependence was confirmed in particular weight categories in both female and male wrestling groups (Table 5).

Table 4. Distribution of scored technical points (n) by male and female athletes in standing and horizontal position.

Variable	Female wrestling			Male free style wrestling		
	standing position	horizontal position	total	standing position	horizontal position	total
Points	906	420	1,326	1,456	469	1,925
average for fight	6.08 ±1.23	2.8 2±0.56****	8.90 ±1.21	6.77 ±1.86	2.18 ±0.89****	8.95 ±1.02

Difference: 0.640; t-statistic: 12.662; ****p<0.0001

Table 5. Distribution of scored technical points (n) by male and female athletes in standing and horizontal position, in particular weight categories.

Female wrestling					Male free style wrestling				
weight category	standing position				weight category	standing position		horizontal position	
	points	average for fight	points	average for fight		points	average for fight	points	average for fight
50 kg	98	6.53 ±2.87	67	4.47 ±0.59****	**57 kg**	126	6.00 ±2.13	48	2.29 ±0.84****
53 kg	104	4.73 ±2.02****	47	2.14 ±1.06	**61 kg**	117	6.88 ±2.68****	30	1.76 ±1.02
55 kg	89	8.09 ±3.11***	45	4.09 ±1.13****	**65 kg**	174	7.25 ±1.97***	53	2.21 ±1.36****
57 kg	86	6.14 ±3.65	36	2.57 ±0.33****	**70 kg**	149	6.48 ±1.85	76	3.30 ±1.08****
59 kg	82	6.31 ±274***	29	2.23 ±0.74****	**74 kg**	182	7.28 ±1.89***	31	1.24 ±0.41****
62 kg	83	5.53 ±2.98****	46	3.07 ±0.72****	**79 kg**	163	7.76 ±1.68****	48	2.29 ±0.97****
65 kg	72	5.14 ±1.13	46	3.29 ±0.95	**86 kg**	147	5.65 ±2.05	41	1.58 ±0.31
68 kg	99	6.60 ±2.82	32	2.13 ±0.69	**92 kg**	112	7.47 ±1.96	24	1.60 ±0.69
72 kg	47	5.22 ±1.62*	15	1.67 ±0.25****	**97 kg**	162	7.36 ±1.47****	59	2.68 ±0.95****
76 kg	149	7.10 ±1.79*	56	2.67 ±0.41	**125 kg**	124	5.90 ±2.43****	59	2.81 ±1.03

***p<0.001; ****p<0.0001

Table 6. Distribution of scored technical points (n) in standing position including chosen technical activities.

Variable	Female wrestling		Male free style wrestling	
	points	average for fight	points	average for fight
leg attack	238	1.60 ±0.74***	548	3.68 ±1.67***
throw	249	1.67 ±0.98	253	1.70 ±1.03
take dawn	218	1.46 ±0.47***	264	1.77 ±0.46***
activity time	69	0.46 ±0.21***	148	0.99 ±0.16***
step out	69	0.46 ±0.11***	138	0.93 ±0.14***
in other	28	0.19 ±0.08****	47	0.32 ±0.18****

***p<0.001; ****p<0.0001

While fighting in standing position (Table 6), male wrestlers gained significantly more points (3.68 ±1.67) by performing leg attack than female wrestlers (1.60 ±0.74). Leg attack was the most dominant technical activity, by which free style wrestlers gained technical points. Whereas, female wrestlers performed both leg attack and throw technical activities (1.67 ±0.98). In all analysed technical activities male wrestlers gained significantly more technical points than female wrestlers.

While fighting in horizontal position (Table 7), the most dominant technical activity among female wrestlers was turn over (1.28 ±0.11), while for male wrestlers, it was gut wrench (0.84 ±0.27).

Technical activities which were used by athletes during the fight are evaluated by referees, who score specific amount of points for specific technical activity. In analysed groups, most of points were scored by performing 2-point technical activities. Both female and male wrestlers (Table 8) performed similar amount of technical activities scored in this way (female wrestling 2.73 ±0.14, free style wrestling 2.82 ±0.16). Male wrestlers performed significantly more 1-point technical activities than female wrestlers (p<0.0001), whereas female wrestlers performed significantly more 4-point technical activities than male wrestlers (p<0.0001). This dependence was confirmed in particular weight categories (Table 9).

Table 7. Distribution of scored technical points (n) in horizontal position including chosen technical activities.

Variable	Female wrestling		Male free style wrestling	
	points	average for fight	points	average for fight
turn over	191	1.28 ±0.11****	124	0.58 ±0.22****
gut wrench	104	0.70 ±0.21****	180	0.84 ±0.27****
caution	104	0.70 ±0.23****	57	0.27 ±0.11****

****p<0.0001

Table 8. Distribution of technical activities (n) for 1, 2, 4 points (average for 1 fight).

Variable	Female wrestling			Male free style wrestling		
	1 point	2 points	4 points	1 point	2 points	4 points
techniques	138	407	61	286	607	60
average for 1 fight	0.93 ±0.33****	2.73 ±0.14	0.41 ±0.21***	1.33 ±0.58****	2.82 ±0.16	0.28 ±0.19***

***<0.001; ****p<0.0001

Table 9. Distribution of technical activities for 1, 2, 4 points in particular weight categories (average for 1 fight).

Weight category	Female wrestling			Weight category	Male free style wrestling		
	1 point	2 points	4 points		1 point	2 points	4 points
50 kg	0.93	3.93	0.40	**57 kg**	1.05	2.71	0.24
53 kg	0.68	2.27	0.36	**61 kg**	1.35	2.29	0.44
55 kg	0.55	4.18	0.55	**65 kg**	1.58	3.00	0.25
57 kg	1.21	2.50	0.50	**70 kg**	1.48	3.22	0.26
59 kg	0.69	2.38	0.46	**74 kg**	0.92	2.76	0.35
62 kg	1.00	2.63	0.33	**79 kg**	1.52	3.19	0.45
65 kg	1.07	2.43	0.29	**86 kg**	1.19	2.65	0.06
68 kg	1.20	2.47	0.40	**92 kg**	1.73	2.13	0.50
72 kg	0.89	1.89	0.33	**97 kg**	1.32	3.09	0.25
76 kg	1.00	2.81	0.48	**125 kg**	1.33	2.86	0.17

DISCUSSION

Many researchers point out that, achieving victory in a wrestling bout does not depend on only one physiological feature. but only variety of physiological profiles can lead to success [26, 27, 29].

Such dependency is indirectly confirmed by many studies which were carried out in recent years. covering analysis of victory structure in wrestling bout. They indicate dominant role of achieving victory in regular time of fight [25-27]. Prevalence of such kind of victory during tournament competition suggests equal sport preparation level of athletes. Carried out research also confirm such tendency, both in female and male competitions such kind of victory was dominant (56% among female, 67% among male). Fundamental difference was established in achieving victory by foul. Analysis of the results of research showed statistically significant difference between female and male in the field of achieving victory by foul (20% among women, 6% among male, p = 0.0001). Statistically significant difference was not present in other types of bouts settlements. Considering type of settlement in particular weight categories. prevalence of winning for points in regular time is also noticeable. Achieving victory by foul in male competition had significantly less share in final settlement of bout. In two weight categories, from 61 kg to 79 kg, there was no fight which settled in such way. In female competition, such type of bout settlement varied from 6.68% in category "to 68 kg", to 33% in category "to 72 kg".

Analysis of bouts of free-style wrestlers. who participated in 2005 World Championships demonstrated that these wrestlers had achieved lower number of technical points (average 7.62 points per fight) than wrestlers who participated in our research (female wrestling 8.90 ±1.21; free style 8.95 ±1.02) [30]. Number of scored points indicates dominance of technical activities in standing position both in female wrestling and free-style wrestling competition. Free-style wrestlers executed more actions in standing position than female wrestlers, but observed difference is statistically insignificant. Activity which is prevailing.

Regarding horizontal position, female wrestlers scored significantly more points than male wrestlers, the difference is statistically significant (female wrestling 2.82 ±0.56, free style 2.18 ±0.89, t-statistic −12.662, p<0.0001).

Comparing particular weight categories. free-style wrestler scored more points than female wrestlers in standing position (free style 79 kg 7.76 ±1.68, female wrestling 62 kg 5.53 ±2.98), however female wrestlers scored more points than free-style wresters in horizontal position (female wrestling 50 kg 4.47 ±0.59, free style 57 kg 2.29 ±0.84). It should be noted, that in 55 kg weight category, female wrestlers scored more points than 65 kg free-style wrestlers in both standing (8.09 ±3.11; 7.25 ±1.97 p<0.001) and horizontal position (4.09 ±1.13; 2.21 ±1.36 p<0.0001).

Carried out studies indicates that leg tackle is the most dominant activity among free-style wrestlers [3, 26, 27, 30].

Such tendency was also observed in our studies. Free-style wrestlers scored average 3.68 ±1.67 points by executing leg tackle, the next technical activity which was used by these athletes is take down (1.77 ±0.46 points).

Distribution of used techniques in female wrestling suggests dominance of throw (1.67 ±0.98 points), while leg tackle is slightly less used technique (1.60 ±0.74 points).

Ito draws attention to diversity of preparation to execute leg tackle within female and free-style wrestlers [28]. Research which was carried out by us indicates dominance in executing different techniques in horizontal position by females and males. Activity which is prevailing among female wrestlers is turn over (1.28 ±0.11 $p<0.0001$), while free-style wrestlers preferred gut wrench (0.84 ±0.27 points, $p<0.0001$).

CONCLUSIONS

Carried out studies indicate differences in wrestling fight structure between female and male wrestlers. Regarding the settling a match, winning by points advantage in a regular fight time dominates both in female wrestling and male free-style wrestling. However, women settled the match by foul more frequently than men (20% among women, 6% among men, $p<0.0001$). A diversity of applied technical actions in both standing and parterre positions was also observed. According to the results obtained. wrestlers have a specific technical in different sex and weight categories. Therefore, coaches could create a specific training programme for athletes.

REFERENCES

1. Yoon J. Physiological Profiles of Elite Senior Wrestlers. Sports Med 2002; 32(4): 225-233
2. Kraemer WJ, Vescovi JD, Dixon P. The Physiological Basis of Wrestling: Implications for Conditioning Programs. Strength Cond J 2004; 26(2): 10-15
3. Latyshev M, Latyshev S, Kvasnytsya O et al. Performance analysis of freestyle wrestling competitions of the last Olympic cycle 2013–16. J Phys Educ Sport 2017; 17(2): 590-594
4. Osipov AY, Nagovitsyn RS, Iermakov SS et al. Increasing of young Greco-Roman wrestlers technical activity level by means of developing coordination and body balance maintaining. Arch Budo Sci Martial Art Extreme Sport 2019; 15: 77-83
5. Rahmani F, Mirzaei B. Comparison of the physical fitness traits of Azerbaijan and Iran senior Greco-Roman national wrestling teams. Phys Educ Students 2019; 3(3): 155-159
6. Hackenschmidt G. Complete science of wrestling. London: Health and strength Ltd; 2011
7. Kraemer WJ, Fry AC, Rubin MR et al. Physiological and performance responses to tournament wrestling. Med Sci Sports Exerc 2001; 33(8): 1367-1378
8. Hübner-Woźniak E, Kosmol A, Lutosławska G, Bem EZ. Anaerobic performance of arms and legs in male and female free style wrestlers. J Sci Med Sport 2004; 7(4): 437-480
9. El-Hamid Emara A. Anaerobic Power for Wrestlers. World J Sport Sci 2010; 3(3): 205-211
10. Venegas-Cardenas D, Caibul-Diaz R, Mons V et al. Physical and physiological profile in youth elite Chilean wrestlers. Arch Budo 2019; 15: 249-257
11. Garcia-Pallarés J, López-Gullón JM, Muriel X et al. Physical fitness factors to predict male Olympic wrestling performance. Eur J Appl Physiol 2011; 111(8): 1747–1758
12. Garcia-Pallarés J, López-Gullón JM, Torres-Bonete M et al. Physical fitness factors to predict female Olympic wrestling performance and sex differences. J Strength Cond Res 2012; 26(3): 794-803
13. Nikooie R, Cheraghi M, Mohamadipour F. Physiological determinants of wrestling success in elite Iranian senior and junior Greco-Roman wrestlers. J Sports Med Phys Fitness 2017; 57(3): 219-226
14. Zaccagni L. Anthropometric characteristics and body composition of Italian national wrestlers. Eur J Sport Sci 2012; 12(2): 145-151
15. Demirkan E, Koz M, Kutlu M et al. Comparison of physical and physiological profiles in elite and amateur young wrestlers. J Strength Cond Res 2015; 29(7): 1876-1883
16. Mirzaei B, Curby DG, Rahmani-Nia F et al. Physiological profile of Iranian junior freestyle wrestlers. J Strength Cond Res 2011; 23: 2339-2344
17. Rzepko M, Drozd S, Żegleń P et al. The Effect of Training Experience on Postural Control in Competitive Wrestlers. J Hum Kinet 2019; 70: 39-45
18. Reid R, Burke LM, Cox GR et al. Body composition of elite Olympic combat sport athletes. Eur J Sport Sci 2020; 20(2): 147-156
19. López-Gullón JM, Muriel X, Torres-Bonete MD et al. Physical fitness differences between Freestyle and Greco-Roman elite wrestlers. Arch Budo 2011; 7(4): 217-225
20. Zi-Hing H, Lian-Shi F, Hao-Jie Z et al. Physiological Profile of Elite Chinese Female Wrestlers. J Strength Cond Res 2013; 27(9): 2374-2395
21. Franchini E, Artioli G, Brito C. Judo combat: time-motion analysis and physiology. Int J Perf Anal Spor 2013; 13(3): 624-641
22. Miarka B, Pérez D, Barreto E et al. Practical application of time-motion analysis of judo female cadets' combats between weight divisions. Int J Perf Anal Spor 2020; 20(4): 701-708
23. Roklicer R, Atanasov D, Sadri F et al. Somatotype of male and female judokas according to weight categories. Biomed Hum Kinet 2020; 12: 34-40
24. United World Wrestling. International wrestling Rules. Corsier-sur-Vevey: United World Wrestling; 2020 [accessed 2020 Sep 25]. Available from: https://uww.org/sites/default/files/2019-12/wrestling_rules.pdf
25. Tunnemann H. Scoring analysis of the 2011 World Championship in Free Style Wrestling. Int J Wrestling Sci 2011; 1: 67-83
26. Kruszewski A, Kruszewski M, Kuźmicki S et al. Directions of changes in match structure in female wrestling based on World Wrestling

Championships 2014 and The Olympic Games 2016 observations. Arch Budo Sci Martial Art Extreme Sport 2019; 15: 45-52

27. Tunnemann H, Curby D. Scoring Analysis of the Wrestling from the 2016 Rio Olympic Games. Int J Wrestling Sci 2016; 6: 90-116
28. Ito S, Crawshaw L, Kanosue K. Differences between male and female elite free-style wrestlers in the effects of "set up" on leg attack. Arch Budo 2019; 15: 131-137
29. Sawczyn S, Lusenko O, Mishchenko V, Pasek M, Dornowski M. The limits of anaerobic glycolytic capacities of skilled wrestlers on the basis of anaerobic testing loads of different duration and character. Arch Budo 2017; 13: 63-70
30. Atan T, İmamoğlu O. Competition analysis Of World Greco-Roman and World free-style wrestling championships. International Journal Performance Analysis in Sport 2005; 5(1): 31-40
31. Dictionary of Sport and Exercise Science: [Over 5000 Terms Clearly Defined]. London: A & C Black; 2006

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