

Dynamics of technical actions of wrestlers of different weight categories groups in Greco-Roman wrestling based on the World Championships 2021

Authors' Contribution:

- A Study Design
- B Data Collection
- C Statistical Analysis
- D Manuscript Preparation
- E Funds Collection

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Abstract

Background and Study Aim:

A wrestling match is characterised by a short, intense, intermittent effort lasting 6 minutes in total for the senior group (1 match = 2 × 3 minutes round), making the need to play 4-5 matches a day during a wrestling tournament an additional element of this effort. The aim of this study is knowledge about the effectiveness of tournament bouts of athletes competing in Greco-Roman wrestling using the example of the World Championships (WSC) in Oslo 2021.

Material and Methods:

Study involved a total of 171 wrestling matches played during the World Championships. 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. Competitors were assigned to three different weight categories groups: light (up to 60kg, 67kg), medium (up to 77kg, 87kg), heavy (up to 97kg, 130kg).

Results:

Athletes in the light categories group undertook more technical actions in the standing position than athletes in the other weight categories groups: light categories (2.04 ±1.4 actions), medium (1.14 ±1.27 actions) and heavy (1.35 ±1.35 actions). In the bout in the horizontal position, significant differences were recorded between the light categories group (2.53 ±1.89 actions) and the medium (1.89 ±1.51 actions) and also between the medium (1.89 ±1.51 actions) and heavy (0.95 ±1.13) categories groups.

Conclusions:

Greco-Roman wrestling matches shows variation according to weight categories groups. Athletes in the light categories group were significantly more likely to successfully perform technical actions in the standing position and the horizontal position than athletes in the medium and heavy categories groups. Therefore, coaches could aim to create specific training programmes for wrestlers taking into account the dynamics of technical actions of different weight groups.

Key words:

combat sports • division of the combat sports • video clips • wrestling match

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

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 [37].

Division of the combat sports under forms of the direct confrontation – workings of weapons; hits (strokes); throws and grips of immobilisation of opponent's body [33].

INTRODUCTION

Wrestling is among the oldest combat sports, practised since the ancient Hellenistic Olympic Games [1, 2]. Regardless of gender and wrestling fighting styles, an optimal level of cardiorespiratory fitness is even necessary to help sustain effort throughout the bout and also to support the recovery process between them and the individual actions in a wrestling bout [3-5]

A wrestling match is characterised by a short, intense, intermittent effort lasting 6 minutes in total for the senior group (1 match = 2 × 3 minutes round), making the need to play 4-5 matches a day during a wrestling tournament an additional element of this effort [6]. During such exercise, bloods' lactate concentrations can raise above 15 mmol/L and sometimes reach almost 20 mmol/L. In comparison, maximum treadmill test results can raise lactate levels to around 10 mmol/L [7, 8]. Research conducted among highly skilled wrestlers indicates that endurance ability is one of the important factors decisive in winning a bout. One of these is anaerobic power in freestyle wrestling, which can play a key role in the final outcome of athletic competition [9, 10].

Modern wrestling tends to increase the intensity of wrestling bouts, which raises the importance of special endurance conditioning the sporting level. The large number of actions (activities) associated with quickly overcoming the opponent's resistance, increasing it, the ability to surprise the opponent and force his reaction in a short time requires a very high level of endurance ability [11-13].

Strength, on the other hand, together with anaerobic capacity, seems to play a critical role in the context of raising the sporting level through motor training. These indices seem to determine in wrestling whether an athlete will be able to present a high sporting level. These variables distinguished well between successful wrestlers and those who had little or no success, regardless of age, weight category and wrestling style [14-16]. Physical fitness parameters such as maximum dynamic strength, isometric strength, explosive strength as well as strength endurance are closely related to high-level wrestling performance. Interestingly, the level of flexibility does not appear to be one of the key fitness variables that help achieve success in high level wrestling. In general, to achieve a high level of performance in

wrestling, training should be aimed at developing power and anaerobic capacity, maximal dynamic and isometric strength, explosive strength and power endurance [17-19].

Upper and lower body strength, anaerobic power, strength endurance [20, 12, 13], reaction time and technical wrestling skills, which included, for example, the hip throw (head and shoulder), suplex throw and back throw differentiated successful wrestlers from their counterparts who were not so successful. Importantly, these results apply to both styles of competition, i.e. Greco-Roman and freestyle [21].

Analysing fights in different weight categories can be an important factor in understanding the specifics of a fight. Understanding how points are most often scored is essential to understanding what determines in a given weight category that some fighters win and others lose [22, 23]. For that matter, does it affect the number of actions in the standing position or the ground position, or simply whether it affects the number of points scored by fighters who win their fights [24, 25].

Therefore, the aim of this study is knowledge about the effectiveness of tournament bouts of athletes competing in Greco-Roman wrestling using the example of the Oslo 2021 World Championships (WSC) in Oslo 2021.

MATERIAL AND METHODS

Study material

A video recordings of technical actions taken during tournament bouts by athletes competing in Greco-Roman wrestling at the World Championships in Oslo (02-10.10.2021) were observed and analysed.

According to the literature, the division of weight categories into 3 main groups, light categories, medium categories and heavy categories was adopted. The athletes were assigned to three different weight categories: light (up to 60 kg and 67 kg), medium (up to 77 kg and up to 87 kg) and also heavy (up to 97 kg and up to 130 kg) [26].

A total of 171 fights were analysed. A total of 52 fights were included in the light categories 64 fights in the medium categories and 55 fights in the heavy categories (Table 1).

Table 1. Breakdown of the weight categories of the athletes who took part in the fight analysis.

Categories group	Weight categories up to:	Number of bouts (n)	
Light	60 kg	22	52
	67 kg	30	
medium	77 kg	36	64
	87 kg	28	
Heavy	97 kg	30	55
	130kg	25	
Total			171

Research methods

A secondary direct analysis method was used to analyse wrestling bouts. This is crucial in terms of spotting details that might not have been recorded during a live fight. The ability to rewind the video avoided such errors. An expert method was also used to evaluate individual measures. One of the authors of the paper is a coach with a lot of experience, having previously practised wrestling, which allows him to objectively assess the technical actions used. All types of scoring actions observed on the recordings were recorded in a pre-prepared observation sheet. Each bout was analysed separately.

Research tools

The research tool was a proprietary observation sheet on which the points scored by the wrestling athletes were marked. This facilitated the recording of the results, which were then transferred to Microsoft Excel.

Research procedure

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). Attempts to perform the action in the standing position and the horizontal position were taken

into account. The points scored by each athlete were also included. The results were then transferred to Microsoft Excel and SPSS. All authors equally contributed to the study.

Statistical analysis

To determine the levels of variance within the groups using samples taken from each group, an one-way ANOVA test was performed – indicating whether there were any statistical differences between the means of the three independent groups (on the weight categories: light, medium, heavy). Differences between groups were determined at the level of statistical significance for $p < 0.05$. Šidák correction – a post-hoc test, to examine between which variables there are statistically significant differences. Within the present study, it was performed for each measurement. A statistically significant difference was set at $p < 0.05$.

Statistical analysis was performed using the Trial version of IBM SPSS v. 26.

RESULTS

Characteristics of technical actions in the standing position

The results indicate that the weight category significantly differentiated the changes occurring in the number of technical actions performed (Table 2).

Table 2. One-way ANOVA for variation in the number of standing actions performed by weight categories groups.

Variable	Sum of squares	df	Mean square	F	Relevance
between groups	36.871	2	18.436	11.434	0.000
within the groups	272.495	169	1.612		
Overall	309.366	171			

Table 3. Post hoc comparisons (Šidák correction) between groups in the context of the number of actions performed in a standing position.

(I) variable		Difference in averages (I–J)	Standard error	P	95% confidence interval	
					lower limit	upper limit
light	medium	0.89711*	0.23583	0.001	0.3284	1.4658
	heavy	1.09228*	0.24442	0.000	0.5028	1.6817
medium	light	–0.89711*	0.23583	0.001	–1.4658	–0.3284
	heavy	0.19517	0.23347	0.789	–0.3679	0.7582
heavy	light	–1.09228*	0.24442	0.000	–1.6817	–0.5028
	medium	–0.19517	0.23347	0.789	–0.7582	0.3679

*The difference in means is significant at the $p < 0.05$ level.

The means differed significantly ($p < 0.05$) for the number of actions performed in the light and medium and light and heavy categories (Table 3).

In the case of the light categories, on average the athletes performed 2.04 ± 1.4 actions per bout for the aforementioned number of points. For the medium categories it was 1.14 ± 1.27 actions, and for the heavy categories 0.95 ± 1.13 . Overall, the average for the entire study group was 1.35 ± 1.35 actions.

Characteristics of technical actions in the horizontal position

The results indicate that the weight category significantly differentiated the changes occurring in the number of actions performed in the horizontal position.

The data show that the averages differed significantly ($p < 0.05$) for the number of actions performed in the light and heavy and medium and heavy categories (Table 5).

Table 4. One-way ANOVA for the variation in the number of actions performed in the ground position by weight categories groups.

Variable	Sum of squares	Df	Mean square	F	Relevance
between groups	68.762	2	34.381	14.589	0.000
within the groups	398.278	169	2.357		
Overall	467.041	171			

* The difference in means is significant at the $p < 0.05$ level.

Table 5. Post hoc comparisons (Šidák correction) between groups in the context of the number of actions performed in parterre position.

(I) variable		Difference in averages (I – J)	Standard error	P	95% confidence interval	
					lower limit	upper limit
light	medium	0.63768	0.28511	0.078	–0.0499	1.3253
	heavy	1.58285*	0.29549	0.000	0.8702	2.2955
medium	light	–0.63768	0.28511	0.078	–1.3253	0.0499
	heavy	0.94517*	0.28226	0.003	0.2645	1.6259
heavy	light	–0.58285*	0.29549	0.000	–2.2955	–0.8702
	medium	–0.94517*	0.28226	0.003	–1.6259	–0.2645

*The difference in means is significant at the $p < 0.05$ level.

Table 6. One-way ANOVA for the variation in the number of points scored by athletes winning their fights according to weight categories.

Variable	Sum of squares	df	Mean square	F	Relevance
between groups	176.143	2	88.071	12.203	0.000
within the groups	121.735	169	7.217		
Overall	1395.878	171			

Table 7. Post hoc comparisons (Šidák correction) between groups in terms of points scored by wrestlers winning their fights – in the context of the actions performed in standing position.

(I) variable		Difference in averages (I – J)	Standard error	P	95% confidence interval	
					lower limit	upper limit
light	medium	-0.23526	0.49895	0.953	-85	0.9680
	heavy	2.03122*	0.51711	0.000	0.7841	3.2783
medium	light	0.23526	0.49895	0.953	-0.9680	1.4385
	heavy	2.26648*	0.49396	0.000	1.0752	3.4577
heavy	light	-2.03122*	0.51711	0.000	-3.2783	-0.7841
	medium	-2.26648*	0.49396	0.000	-3.4577	-1.0752

*The difference in means is significant at the $p < 0.05$ level.

For the light categories, on average, the athletes performed 2.53 ± 1.89 actions per bout for the aforementioned number of points. For the medium categories, it was 1.89 ± 1.51 actions and for the heavy categories 0.95 ± 1.13 . Overall, the average for the entire study group was 1.78 ± 1.65 actions.

Characteristics of scoring actions by wrestlers winning their fights

The results show that the weight category significantly differentiated the changes occurring in the number of technical actions performed by wrestlers winning their bouts (Table 6).

The data shows that the means were significantly different for the points scored by the wrestlers winning their fights were shown between the light and heavy weight categories, and medium and heavy weight categories ($p < 0.05$) (Table 7).

In the case of the light categories, on average, wrestlers winning their bout scored 6.36 ± 2.84 points. In the case of the medium categories, it was 6.59 ± 2.99 points, and in the heavy categories 4.33 ± 2.11 points. Overall, the average for the entire study group was 5.80 ± 2.86 points scored by wrestlers winning their bout.

DISCUSSION

Many researchers point out that achieving victory in wrestling does not depend on just one physiological trait. but only a diversity of physiological profiles can lead to success [26-28]. In addition, the research conducted indicates that the rivalry between competitors regardless of weight category and fighting style is mainly decided in regulation bout time. The prevalence of this type of winning in tournament competition suggests an equal level of sporting preparation among wrestlers [26, 25, 28].

The researchers' analysis showed that Greco-Roman style athletes perform significantly less technical actions than freestyle and women wrestlers [29]. The number of points scored shows the dominance of technical action in the standing position in both women's wrestling and freestyle and Greco-Roman wrestling competitions [24, 25, 28].

Our study additionally showed differences in the technical actions in the standing position of Greco-Roman style wrestlers, in the area of weight categories groups. The analysis showed that the results differed significantly between the light (2.04 ± 1.4 shares) and medium (1.14 ± 1.27 shares) and heavy (1.35 ± 1.35 shares) categories.

Wrestlers in the light weight categories group undertook the most technical actions. It can be assumed that the physical indicators characterised by the wrestlers of this group allow them to perform more actions. Thus, a lower body mass with a high level of relative strength and relative power may be physical indicators that will predispose athletes in the light weight categories to be more active during combat [27, 29].

Bouts in horizontal (in wrestling jargon: *parterre*) position differentiate wrestlers in the area of weight categories according to gender and fighting style [30, 28]. For actions taken in horizontal position, the largest significant differences were recorded between the light (2.53 ± 1.89 actions) and medium (1.89 ± 1.51 actions) categories and also between the medium (1.89 ± 1.51 actions) and heavy (0.95 ± 1.13) categories. Again, the results indicate that as the weight category increased, the athletes undertook significantly fewer actions. As with the standing (vertical) position, it can be concluded that physical factors are responsible for the fact that as body weight increases, athletes undertake fewer technical actions in the horizontal position. Thus, the body will need much more time to recover between the various spurts. This would be due to the fact that, during the fight, heavyweight fighters being in the horizontal position rested a lot more time than will be the case with the middle or, above all, the light weight categories. It seems that it is the representatives of the light weight categories who will be among the wrestlers leading the way in the number of actions taken. The potential for strength and power will continue to play a significant role, which will be reflected in the wrestlers' ability to undertake [29, 30, 28].

Of course, the results also confirmed the fact that a higher score leads to a higher chance of winning the fight. It is important to emphasise that these may not always be the decisive factor in a competitor's victory, as various unforeseen situations may lead to the competitor eventually giving up, suffering an injury or being disqualified through their own mistake. Statistically significant differences ($p < 0.05$) in this context were shown between the light (6.36 ± 2.84) and heavy (5.80 ± 2.86 points) categories, as well as the medium (6.59 ± 2.99 points) and heavy (5.80 ± 2.86 points) categories.

The seemingly obvious limitation of these studies is the effectiveness of wrestling activities.

It is known that the ultimate winner of each weight categories in wrestling, as in any other combat sports and individual sports, is only one competitor. But it is also known that even top-class champions are often beaten by novices as well. However, it is not the sporting dimension of wrestling, but wrestling as a relatively mild self-defence art that changes the perception of these research results. The brutalization of interpersonal relations, including through the media promotion of neo gladiatorship [31, 32], requires opposing physical aggression in accordance with the criteria of self-defence. Many wrestling techniques, effectively used in self-defence, increase the probability of not exceeding the limits of intervention defined in penal codes. The shortcoming of wrestling and other combat sports from the group of throws and grips of immobilization of opponent's body [33] is the lack of techniques for avoiding strikes. Therefore, an important element of, among others, wrestling training is the introduction of self-defence exercises against various forms of aggression. The unique results of the case studies of Michnik et al. [34] provide evidence that the effect of many years of self-defence training combined with various combat sports shapes optimal habits of avoiding collisions with moving objects. The remarks and recommendations contained in this paragraph refer to the most important justifications of combat sports theory [33], which is crucial for the science of martial arts subdiscipline [35, 36].

CONCLUSIONS

Greco-Roman wrestling shows variation according to weight categories groups. Athletes in the light categories group (2.04 ± 1.4 actions) were significantly more likely to successfully perform technical actions in the standing position than athletes in the medium (1.14 ± 1.27 actions) and heavy (1.35 ± 1.35 actions) groups. For actions in the horizontal position, the largest significant differences were noted between the light (2.53 ± 1.89 actions) and medium (1.89 ± 1.51 actions) categories and also between the medium (1.89 ± 1.51 actions) and heavy (0.95 ± 1.13) categories.

Practical applications

Therefore, coaches could aim to create specific training programmes for wrestlers taking into account the dynamics of the technical actions of different weight groups.

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