PHYSICAL EDUCATION OF STUDENTS

ORIGINAL ARTICLE

Comparison of physical performance profiles in freestyle and Greco-Roman wrestlers

Gökhan Deliceoğlu[1ABCE], Erkan Tortu[2ABD], Selman Kaya[3AB]

[1]*Faculty of Sport Sciences, Coaching Training Department, Gazi University, Ankara, Turkey*
[2]*Faculty of Sport Sciences, Coaching Training Department, Trabzon University, Trabzon, Turkey*
[3]*Faculty of Sport Sciences, Coaching Training Department, Yalova University, Yalova, Turkey*

Authors' Contribution: A – Study design; B – Data collection; C – Statistical analysis; D – Manuscript Preparation; E – Funds Collection

Abstract

Background and Study Aim: This study aimed to examine the differences between a range of performance parameters in Greco-Roman and freestyle wrestlers.

Material and Methods: The study group consisted of 60 young wrestlers, of which 30 were Greco-Roman, and 30 were freestyle. The parameters analysed in the study included aerobic endurance, lower and upper extremity anaerobic power and capacity, postural sway, change of direction, sprint (5m-10m-20m-30m), and visual reaction. After calculating mean and standard deviation values with descriptive statistical methods, the conformity of all variables to normal distribution was checked with the Shapiro-Wilk Test. Differences between freestyle and Greco-Roman wrestlers were determined by t-test for independent samples. A discriminant function analysis was also utilized to discover which set of factors best distinguished freestyle and Greco-Roman wrestlers. The homogeneity matrices were tested for equality of covariance using Box's M test. Data collinearity was investigated in order to find correlations between independent variables. The statistical significance level was accepted as $p<0.05$.

Results: Aerobic endurance, lower and upper extremity anaerobic power and capacity, postural sway (Right Foot Anterior-Posterior, Left Foot Total, Left Anterior-Posterior, Left Foot Medial-Lateral), change of direction, 5m and 10m sprint values, and visual reaction values of Greco-Roman and Freestyle wrestlers were found similar ($p>0.05$). In contrast, a significant difference ($p<0.05$) was seen in 20m and 30m sprints, double foot total, anterior-posterior, medial-lateral, right foot total, and right foot medial-lateral postural sway values.

Conclusions: Contrary to expectations, it was seen that the leg anaerobic power values of Greco-Roman athletes and the arm anaerobic values of freestyle wrestlers were higher than other style wrestlers, with minor difference. Greco-Roman and freestyle wrestlers can be said to show similar performance values despite the different wrestling techniques and training methods they use.

Keywords: wrestling, physical performance, postural sway, anaerobic power, visual reaction, sprint

Introduction

Dating back to ancient Olympics, wrestling has become an inseparable part of national and international sports organizations, standing out as an important combat sport whose popularity has been ever-increasing from the 1896 modern Olympics to the present. Historically, wrestling first emerged in the Greek (Greco) society, followed by the Romans. Both societies made wrestling a part of their social lives, and subsequently, also of the athletic games they organized [1]. In the course of time, wrestling became more effective and gained popularity all over the world, taking on the name Greco-Roman wrestling as a tribute to the two societies it had emerged from [1, 2].

There are two styles of wrestling officially recognized by the Olympic Committee. Greco-Roman is known as the classical style and it forbids any holds below the waist [3, 4]. Freestyle, on the other hand, is considered as an alternative style that allows holds involving both the upper and lower body, meaning that the whole body can be used. [3, 4]. Wrestling is a sport discipline characterised by high-intensity combat with a total of 6 minutes (2 x 3 minutes) of competition in both styles. Therefore, wrestlers undergo frequent and intense training in order to attain a high-level physical profile [5, 6].

The primary aim of wrestling is to gain superiority over the opponent by using technical, tactical and psychological factors as well as physical performance [7]. Wrestlers have to compete with more than one opponent in a day in wrestling matches [8, 9, 10]. The way to success in elite level wrestling sport requires superior physical and physiological abilities.

The anaerobic ATP-CP (adenosine triphosphate-creatine phosphate) and anaerobic glycolytic systems, as well as the aerobic system, are utilised

doi:10.15561/20755279.2022.0602

in both Greco-Roman and freestyle [11]. Wrestlers are required to have a strong anaerobic energy metabolism in order to perform high-intensity attacks and counterattacks that necessitate strength, muscular power, and isometric force [5, 12].

The lower and upper body's anaerobic strength is also critical for wrestling success, as it aids in attacking and lifting the opponent during offensive techniques, as well as resisting the opponent's strikes. Anaerobic power is another criterion that could help to draw a distinction between successful and unsuccessful wrestlers.

Wrestlers must also have strong aerobic capacity since they undertake acts that require all-out bursts of maximum power with only a few seconds of recovery time [11, 13]. During the match, top-level wrestlers do approximately 16 high-intensity actions lasting 3.1 seconds each, with a 23.6-second variable-intensity recovery time [14]. To succeed in competition, wrestlers must possess numerous unique qualities, including maximal strength, aerobic endurance, and anaerobic skills [15].

The capacity to lift the opponent during attack and resist strikes when on defence demonstrates the importance of lower and upper body force [3, 16]. High maximal power production in arm and leg muscles has been a characteristic of elite wrestlers [17], since there is a direct relationship between optimal performance and strength in wrestling [18].

Pulling and pushing repeatedly, controlling takedowns, and maintaining or resisting the arch posture all necessitate strength and core and postural stability in wrestling. Wrestlers' defensive power increases when they maintain postural stability and body control in difficult circumstances [19].

Different techniques applied in Greco-Roman and freestyle wrestling show that different performance parameters come to the fore in displaying maximum performance in both styles [3, 10, 20], and the training methods to be applied to the wrestlers of both styles should be planned accordingly.

Purpose of the Study. The study purpose was to determine the performance differences that will help trainers and conditioners to prepare scientific-based training programs and optimize training interventions in order to achieve high performance in freestyle and Greco-Roman wrestling.

Materials and Methods

Participants

A total of 60 wrestlers (30 freestyle and 30 Greco-Roman style) participated in this study, each being a member of a wrestling training centre in Turkey and a medallist in national and international competitions. The study complied with the Declaration of Helsinki and was approved by the Bioethics Commission of the University of Yalova in Turkey (Protocol No: 2022/03). The physical characteristics and training experience of the Freestyle and Greco-Roman wrestlers are presented in Table 1.

Study Design

This study was designed to compare the performance parameters of Greco-Roman and freestyle wrestlers. Wrestlers at Turkey wrestling training centres participated in this study voluntarily. The tests conducted under this study included aerobic endurance, anaerobic power, sprint, agility, visual reaction tests and postural sway analysis. The participants' parents read and signed an informed consent form before the participants were enrolled to the study. The athletes were not allowed to participate in daily training programs in the 24 hours preceding testing. On six different days, all of the wrestlers were tested in the same laboratory and outdoor facilities. The participants and their coaches were informed about the experimental procedures as well as the project's potential hazards and

Table 1. Descriptive characteristics of Freestyle and Greco-Roman wrestlers.

Parameters	Greco-Roman	Freestyle	t	p
Age (years)	19.90 ± 0.29	18.49 ± 0.32	2.983	0.004
Height (cm)	171.76 ± 6.80	165.46 ±8.07	3.268	0.002
Body mass (kg)	70.83 ±12.55	65.33 ±15.33	1.520	0.134
Fat %	9.4 ±5.6	8.2±6.3	1.215	0.048
FFM (kg)	66.7±11.23	53.3 ±13.30	1.849	0.005
BMI (kg/m^2)	23.94 ±3.55	23.61 ±3.76	0.337	0.737
Training experience (years)	6.06 ±1.48	5.8 ±1.93	0.599	0.552
VO_{2max} ($ml.kg^{-1}.min^{-1}$)	53.74 ±3.76	53.45 ±4.30	0.341	0.733

Subject characteristics were measured mean ± SD; FFM - Fat Free Mass; BMI - Body Mass Index; p>0.05

advantages. The participants were given the option to conduct the tests at submaximal intensity after a familiarization session at the start of the study. All of the participants' measurements were taken on six different days in total. The tests were conducted between 9:00 a.m. and 11:00 a.m. Throughout the trial, all participants followed the same diet plan as devised by their dietician. Subjects were verbally encouraged to maximize their performance in the tests (Figure 1).

Day 1	Familiarization
Day 2	Measurement of physical characteristics and VO_{2max} Test
Day 3	Wingate Leg Test
Day 4	Visual Reaction Test
	Wingate Arm Crank Test
Day 5	Sway Analysis Test
	Sprint Test
Day 6	Change of Direction Test
A rest period of 48 hours was applied between testing days.	
On days with 2 tests, the tests were performed one in the morning and one in the afternoon.	

Figure 1. Study Design

Physical Characteristics

Body mass (BM), body fat percentage (Fat %), and fat free mass FFM (kg) were measured using the bioelectrical impedance analysis method (BIA) (MC 980, Tanita Corp.,1000 kHz, Japan) after 12 hours of fasting.

Maximum Oxygen Consumption Test

The participants' VO_{2max} values were determined using a Yo-Yo intermittent recovery test (level 1). This test comprised 20-meter shuttle runs at increasing speeds, followed by 10 seconds of active recovery (consisting of 2x5-meter jogging) until fatigue. The test began at a speed of 10 kmh^{-1} and increased till exhaustion [21].

Audio beeps from a smartphone application regulated the speed. The test was terminated when the participants failed to cross the finish line in time twice, and the covered distance was recorded as the valid score, which was then employed in the calculation below [22]:

$$VO_{2max}\ (ml.kg^{-1}.min^{-1}) = \text{distance (m)} \times 0.0084 + 36.4$$

Anaerobic Power and Capacity Tests

On different days, the participants conducted 30-second Wingate anaerobic tests on an adjustable Monark cycle ergometer (Model 894-E, Stockholm, Sweden) to evaluate anaerobic power and capacity. For each participant, the Wingate leg test consisted of maximal cycling in a standing body position against a resistance load of 75 $g.kg^{-1}$ BM, while the Wingate arm crank test consisted of maximal cycling in a standing body posture against a resistance load of 55 $g.kg^{-1}$ BM. The cycle set was calibrated according to manufacturer's instructions before each test. The individuals warmed up by pedalling at 60–70 rpm for 5 minutes, followed by 3 all-out sprints in the last 5 seconds of the last 3 minutes. The individuals were then given a 5-minute passive rest time. The cadence speed was monitored in real time simultaneously during the tests (the participants could see through the monitor). The peak power (PP) in watts for any 5-second period was computed, as was the mean power (MP) for the 30 seconds. In addition, BM-related relative values were determined.

Sprint test

The participants performed a sprint test that consisted of two maximal 30 m sprints with timing at 5m, 10m, 20m, and 30 m, with a 3 minute rest time between each sprint, after a standardized 15-minute warm-up (low-intensity running, multiple acceleration runs, and stretching activities).

Pro-agility Test

Pins were set 5 yards (4,57m) to the left and right of the pro-agility test, often known as 20 yard running test. At the starting line, a timing gate (Microgate, Bolzano, Italy) was installed. Repeated passes were documented in this manner. Wrestlers took their positions before the test began. Once ready to start, the wrestlers were instructed to touch the pins alternatingly, starting with the pin to the right and then the one to the left, then cross the starting line and complete the test. The total time for each participant was recorded.

Postural sway analysis

The centre-of-pressure data was collected using a Kistler 9281C force platform (400 x 600 mm) based on piezoelectrical measurement of ground-reaction force in the anteroposterior (AP), mediolateral (ML), and vertical planes. Participants stood with their feet together and arms at their sides, barefoot. Postural sway was measured under three different position feedback conditions, namely double leg, right leg, and left leg. During sway analysis, participants were asked to fix their attention on a stationary object positioned 2 meters in front of them at eye level. Wrestlers were put through familiarization tests, and each trial (double and singles leg) lasted 30 seconds, followed by a one-minute rest period. The experiments were conducted in random order. Total average sway, AP, and ML directions were determined using 30-second centre of pressure (COP) data.

Reaction time

The Witty SEM diagnostic system was used to assess reaction time to eight visual stimuli. Microgate Witty SEM is a technology that consists of "intelligent traffic lights", which are made up of a matrix of multicoloured 7x5 Light Emitting Diode (LED) that can manage various symbols and colours. Eight light photocells were set on a board across

from the wrestlers. The aim was to use a dominant hand to react as quickly as possible to photocells that lit up blue. Other photocells displayed a variety of colours or none at all. This experiment included 60 visual reactions with a producing time of one second. Total time was calculated from the better of two tries.

Statistical Analysis

SPSS version 21.0 software was used for statistical analysis, and a p value of 0.05 was considered significant. Normality of data was controlled using the Shapiro-Wilk test. The data was examined with descriptive statistics, and the findings were reported as mean standard deviation. An independent t-test was used to examine the differences between young freestyle and Greco-Roman wrestlers. Additionally, the effect size (0.2: small, 0.5: medium, and 0.8: big) was evaluated to determine practical significance [23]. A discriminant function analysis was also utilized to discover which set of factors best distinguished freestyle and Greco-Roman wrestlers. The homogeneity matrices were tested for equality of covariance using Box's M test. Data collinearity was investigated in order to find correlations between independent variables. The discriminant function analysis model removed variables that were highly linked (r > 0.70) with each other. The characteristics that distinguished freestyle and Greco-Roman wrestlers were determined using the structural coefficient. For the interpretation of linear vectors, a structural coefficient greater than 0.30 was considered significant.

Results

The characteristics and training experiences of Greco-Roman and Freestyle wrestlers are presented in Table 1. Age, height, Body Fat % and FFM values of Greco-Roman and Freestyle wrestlers differed significantly ($p<0.05$), yet without any significant difference in terms of body mass, BMI, training experiences and VO_{2max} values ($p>0.05$).

According to arm and leg anaerobic power and capacity test results, there was a statistically significant difference between Leg PD values of freestyle and Greco-Roman wrestlers ($p<0.05$). However, no significant difference was seen in both leg and arm PP, RAP, AP and RAP values between the groups ($p>0.05$) (Table 2).

According to postural sway test results, there was a statistically significant difference in all sway directions in double leg and right leg ($p<0.05$). But there was no significant difference between the groups in all left leg sway directions ($p>0.05$) (Table 3).

Agility, 5m, 10m and visual reaction of Greco-Roman and Freestyle wrestlers were similar ($p>0.05$). When the 20m and 30m sprint values are examined, it is seen that Greco-Roman wrestlers are faster than Freestyle wrestlers ($p<0.05$) (Table 4).

The administered power, sprint, visual reaction, agility, and postural sway tests classified the freestyle and Greco-Roman wrestlers correctly by 66,7% (Table 5).

Discussion

In this study, we examined the differences between the performance parameters of Greco-Roman and freestyle wrestlers. The results of the study showed that, while the height (cm), fat% and FFM (kg) of Greco-Roman and freestyle wrestlers displayed similar characteristics, there was a significant difference in body weight (kg), training experience (years) and VO_{2max} characteristics (Table 1). Although there was no significant difference between the Peak Power (PP), Relative Peak Power (RPP), Average Power (AP), Relative Average Power

Table 2. Comparison of leg and arm anaerobic power and capacity.

Leg	**Greco-Roman**	**Freestyle**	**t**	**p**	**ES**
Peak Power (W)	922.6 ±167.14	844.77 ±210.50	1.586	.118	0.40
Relative Peak Power (W/kg)	13.25 ±2.08	12.96 ±1.46	.608	.545	0.16
Average Power (W)	621.63 ±102.80	577.75 ±139.05	1.390	.170	0.35
Relative Average Power (W/kg)	8.86 ±0.62	8.84 ±0.69	.078	.938	0.03
Power Drop (%)	63.64 ±10.50	57.82 ±6.94	2.535	.014	0.65
Arm	**Greco-Roman**	**Freestyle**	**t**	**p**	**ES**
Peak Power (W)	800.78 ±188.29	771.04 ±185.24	.617	.540	0.15
Relative Peak Power (W/kg)	11.33 ±1.80	11.93 ±2.12	-1.177	.244	0.30
Average Power (W)	424.17 ±82.52	395.29 ±89.60	1.298	.199	0.33
Relative Average Power (W/kg)	6.00 ±0.52	6.08 ±0.59	-.552	.583	0.14
Power Drop (%)	81.06 ±10.84	80.79 ±10.81	.094	.925	0.02

ES - effect size

Table 3. Comparison of postural sway.

Sway Analysis (Eyes Open)	Greco-Roman	Freestyle	t	p	ES
Double Leg Total (mm)	315.4 ±79.66	372.90 ±102.34	-2.428	0.02	0.62
Double Leg Anterior-Posterior(mm)	230.5 ±60.92	263.16 ±64.78	-2.012	0.05	0.52
Double Leg Medial-Lateral(mm)	165.36 ±52.66	206.73 ±75.86	-2.453	0.02	0.64
Right Foot Total (mm)	1366.33 ±272.49	1551.06 ±437.47	-1.963	0.05	0.51
Right Foot Anterior-Posterior(mm)	865.13 ±183.95	975.66 ±345.49	-1.547	0.03	0.39
Right Foot Medial-Lateral(mm)	879.43 ±187.65	1002.73 ±236.09	-2.239	0.03	0.57
Left Foot Total (mm)	1350.40 ±348.21	1465.03 ±566.88	-.944	0.35	0.24
Left Foot Anterior-Posterior(mm)	876.20 ±278.30	920.40 ±445.68	-.461	0.65	0.11
Left Foot Medial-Lateral(mm)	853.90 ±186.12	945.50 ±279.89	-1.493	0.14	0.38

ES - effect size

Table 4. Comparison of agility, speed, and reaction.

Agility (s)	Greco-Roman	Freestyle	t	p	ES
Pro-Right Side	2.65 ±0.15	2.65 ±0.11	.067	.947	0
Pro-Left Side	2.46 ±0.12	2.49 ±0.13	-.893	.375	0.23
Pro-Total	5.11 ±0.23	5.13 ±0.19	-.337	.737	0.09
Sprint (s)	Greco-Roman	Freestyle	t	p	EB
5m	1.06 ±0.08	1.09 ±0.09	-1.292	.201	0.35
10m	1.83 ±0.07	1.86 ±0.09	-1.265	.211	0.37
20m	3.16 ±0.10	3.23 ±0.16	-2.136	.037	0.52
30m	4.42 ±0.14	4.57 ±0.126	-2.812	.007	1.15
Reaction	**Greco-Roman**	**Freestyle**	**t**	**p**	**ES**
Visual	48.73 ±4.5	49.50 ±5.6	-.586	.560	0.15

ES - effect size

Table 5. Classification of groups according to the discriminant function[a]

Original group	n of cases	Predicted group membership	
		Greco-Roman	Freestyle
Greco-Roman	30	%70 (21)	%63,3 (19)
Freestyle	30	%36,7 (11)	%30,7 (9)

a. 66,7% of original grouped cases correctly classified.

(RAP) values of leg and arm anaerobic power and capacities between the groups, it was observed that the anaerobic power capacity values of Greco-Roman wrestlers were higher than those of Freestyle wrestlers, which shows that there is a significant difference between leg Power Drop (PD %) values for both groups (Table 2).

When the literature is examined, it can be seen that the number of studies examining the differences in anaerobic power and capacity between wrestling styles is limited. Demirkıran et al. examined the differences between certain physical fitness parameters of young Greco-Roman and freestyle wrestlers [3]. They found that, while lower extremity anaerobic power and capacity values (except RAP) were similar, arm anaerobic power and capacities were higher in Greco-Roman style wrestlers. The authors attributed this difference between the two styles to the fact that Greco-Roman wrestlers perform dynamic movements (i.e. lifting, throwing, and resisting the opponent) both during training and in competition, and that all techniques in the Greco-Roman style involve the upper body.

In contrast, in a study by Kılınç and Özen the

authors compared the anaerobic power values of elite freestyle and Greco-Roman wrestlers, no significant difference could be found between the absolute and relative anaerobic values of the leg and arm in both styles [24].

Similarly, Lopez-Gullon et al. did not find any significant differences in arm anaerobic power and capacity (absolute or RPP and AP) results [25], which results support the findings of our study. The results of studies examining wrestlers at different competitive levels showed that elite male wrestlers had higher leg and arm PP and MP values compared to amateur wrestlers [15, 18, 26]. The authors attributed this difference to higher lean body mass and greater neural activation in elite wrestlers.

Garcia Pellares et al. (2012) compared female wrestlers according to different levels of competition (elite-amateur) and weights (light-middle). Their study revealed that amateur wrestlers had lower upper extremity MP and PP values compared to elite wrestlers (17.3-23%) [7]. Against this background, anaerobic power and capacity level seem to be critical indicators of achieving high-level success in wrestling [5]. Studies comparing the weights of wrestlers showed that heavier wrestlers had higher absolute arm and leg PP and MP values in both genders [11, 15, 18, 25, 27, 28].

In study aimed at determining the hierarchy of success factors in wrestling regardless of style and weight class, Cieśliński et al. found that the peak strength of upper extremity muscles was at the top of the success factors in wrestling [29]. As a result, previous studies have reported that anaerobic power and capacity are important variables to accurately distinguish between successful and unsuccessful athletes, regardless of wrestling style, age category and weight [5]. However, due to the different results between studies, further studies should be conducted in the future.

To the best of our knowledge, no study was conducted yet to compare the postural sway values of Greco-Roman and Freestyle wrestlers. In this study, freestyle wrestlers were found to have higher postural sway values than Greco-Roman style wrestlers. However, this difference was not statistically significant. One of the reasons why freestyle wrestlers have higher postural sway values may be because they have less muscle mass and less leg anaerobic power. Furthermore, the hamstrings of freestyle wrestlers are more extensible than those of Greco-Roman wrestlers because freestyle wrestlers do more flexibility exercises during training, whereas Greco-Roman wrestlers do more lateral trunk bending than freestyle wrestlers.

Few researchers in the literature have examined the reaction times of wrestlers [29, 30, 31]. In our study, no significant difference was found between the visual reaction times of Greco-Roman and freestyle wrestlers ($p>0.05$).

In the study examining the reaction times of Greco-Roman and freestyle wrestlers, Mirzaei et al. reported that there was no difference between the reaction times between the groups , which result is similar to that of our study [31]. Gierczuk et al. examined the changes in reaction times of Greco-Roman wrestlers and the relationship between their reaction times and their technical and tactical actions during a match, as a result of which they found that elite wrestlers showed a smaller improvement in reaction time and performed more technical and tactical moves during a match. There are studies where the ability to react quickly at sub-maximal intensity is reported to be an important factor in determining the outcome of competition [32].

Cieśliński et al. reported that the response time to light signal was an important success factor in wrestling [29], because during a match, wrestlers need to properly record, process and counter the different moves of their opponents. Therefore, reaction time in wrestling is of particular importance and should not be ignored in determining performance.

The sprint and change of direction values of Greco-Roman and Freestyle wrestlers in our study are given in Table 4. There was no significant difference between 5m, 10m, visual reaction and agility values in both groups ($p>0.05$). However, there was a significant difference between the 20m and 30m sprint values in both groups ($p<0.05$).

Baic et al. did not find a significant difference between the 20m sprint values of Greco-Roman and freestyle wrestlers [33]. Lopez-Gullon et al. determined that there was no difference between the 10m sprint values of the Greco-Roman and freestyle wrestlers according to weight [25]. Mirzaei et al. showed in their study that the 40 yard sprint values of Greco-Roman and freestyle wrestlers were similar [31]. Demirkıran et al. found in their study a significant difference between the 10 m and 30 m sprint and agility values of Greco-Roman and freestyle wrestlers [3].

Conclusions

Contrary to expectations, it was seen that the leg anaerobic power values of Greco-Roman athletes and the arm anaerobic values of freestyle wrestlers were higher than other style wrestlers, with minor difference. Styles showing similarity in agility and acceleration speed parameters were superior to Greco-Roman style wrestlers in terms of postural sway, visual reaction, and speed values. This finding can be associated with the balance and speed superiority of Greco-Roman wrestlers, especially in leg anaerobic power. As a result, Greco-Roman wrestlers can be said to give greater importance to strength and strength-enhancing parameters, while the methods of workout in different wrestling styles have influence on anaerobic power, balance, and reaction characteristics.

References

1. Beekman S. *Ringside: A history of professional wrestling in America*. Greenwood Publishing Group; 2006.
2. Ulupınar S, Özbay S. Energy pathway contributions during 60-second upper-body Wingate test in Greco-Roman wrestlers: intermittent versus single forms. *Research in Sports Medicine*, 2021:1–12. https://doi.org/10.1080/15438627.2021.1895784
3. Demirkan E, Kutlu M, Koz M, Özal M, Favre M. Physical fitness differences between freestyle and Greco-Roman junior wrestlers. *Journal f Human Kinetics,* 2014;41:245. https://doi.org/10.2478/hukin-2014-0052
4. Yard EE, Comstock RD. A comparison of pediatric freestyle and Greco-Roman wrestling injuries sustained during a 2006 US national tournament. Scandinavian journal of medicine & science in sports. 2008;18(4):491–7. https://doi.org/10.1111/j.1600-0838.2007.00716.x
5. Chaabene H, Negra Y, Bouguezzi R, Mkaouer B, Franchini E, Julio U, et al. Physical and physiological attributes of wrestlers: an update. The Journal of Strength & Conditioning Research. 2017;31(5):1411–42. https://doi.org/10.1519/JSC.0000000000001738
6. Thomas RE, Zamanpour K. lnjuries in wrestling: systematic review. The Physician and sportsmedicine. 2018;46(2):168–96. https://doi.org/10.1080/00913847.2018.1445406
7. Pallarés JG, López-Gullón JM, Torres-Bonete MD, Izquierdo M. Physical fitness factors to predict female Olympic wrestling performance and sex differences. The Journal of Strength & Conditioning Research. 2012;26(3):794–803. https://doi.org/10.1519/JSC.0b013e31824741e7
8. Isik O, Cicioglu HI, Gul M, Alpay CB. Development of the wrestling competition analysis form according to the latest competition rules. International Journal of Wrestling Science. 2017;7(1-2):41–5. https://doi.org/10.1080/21615667.2017.1422815
9. Barbas I, Fatouros IG, Douroudos II, Chatzinikolaou A, Michailidis Y, Draganidis D, et al. Physiological and performance adaptations of elite Greco-Roman wrestlers during a one-day tournament. European journal of applied physiology. 2011;111(7):1421–36. https://doi.org/10.1007/s00421-010-1761-7
10. Özbay S, Ulupınar S. Strength-Power Tests are More Effective When Performed After Exhaustive Exercise in Discrimination Between Top-Elite and Elite Wrestlers. *Journal of Strength and Conditioning Research,* 2022;36(2): 448–454. https://doi.org/10.1519/JSC.0000000000003456
11. Mirzaei B, Curby DG, Rahmani-Nia F, Moghadasi M. Physiological profile of elite Iranian junior freestyle wrestlers. The Journal of Strength & Conditioning Research. 2009;23(8):2339–44. https://doi.org/10.1519/JSC.0b013e3181bb7350
12. Karnincic H, Tocilj Z, Uljevic O, Erceg M. Lactate profile during Greco-Roman wrestling matchx. *Journal of Sports Science & Medicine,* 2009;8(CSSI3):17.
13. Passelergue PA, Lac G. Salivary hormonal responses and performance changes during 15 weeks of mixed aerobic and weight training in elite junior wrestlers. *The Journal of Strength & Conditioning Research*, 2012;26(11):3049–58. https://doi.org/10.1519/JSC.0b013e3182473e3d
14. Cipriano N. A technical-tactical analysis of freestyle wrestling. *The Journal of Strength & Conditioning Research*, 1993;7(3):133–40. https://doi.org/10.1519/00124278-199308000-00002
15. Demirkan E, Koz M, Kutlu M, Favre M. Comparison of physical and physiological profiles in elite and amateur young wrestlers. *The Journal f Strength & Conditioning Research,* 2015;29(7):1876–83. https://doi.org/10.1519/JSC.0000000000000833
16. Starosta SSW. Selected factors influencing the level of general fitness in elite Greco-Roman wrestlers. *Journal of Human Kinetics*, 2005;2005:14.
17. Yoon J. Physiological profiles of elite senior wrestlers. *Sports Medicine*, 2002;32(4):225–33. https://doi.org/10.2165/00007256-200232040-00002
18. García-Pallarés J, López-Gullón JM, Muriel X, Díaz A, Izquierdo M. Physical fitness factors to predict male Olympic wrestling performance. *European Journal of Applied Physiology*, 2011;111(8):1747–58. https://doi.org/10.1007/s00421-010-1809-8
19. Basar S, Duzgun I, Guzel NA, Cicioğlu I, Çelik B. Differences in strength, flexibility and stability in freestyle and Greco-Roman wrestlers. *Journal of Back qnd Musculoskeletal Rehabilitation,* 2014;27(3):321–30. https://doi.org/10.3233/BMR-130451
20. Arı Y. Effects of different stretching methods on speed, jump, flexibility and upper extremity performance in wrestlers. *Kinesiologia Slovenica*, 2021;27(1):162–176. https://doi.org/10.52165/kinsi.27.1.162-176
21. Krustrup P, Mohr M, Nybo L, Jensen JM, Nielsen JJ, Bangsbo J. The Yo-Yo IR2 test: physiological response, reliability, and application to elite soccer. *Medicine and Science in Sports and Exercise,* 2006;38(9):1666. https://doi.org/10.1249/01.mss.0000227538.20799.08
22. Bangsbo J, Iaia FM, Krustrup P. The Yo-Yo intermittent recovery test. Sports medicine. 2008;38(1):37–51. https://doi.org/10.2165/00007256-200838010-00004
23. Cohen J. *Statistical power analysis for the behavioral sciences*. Routledge; 2013. https://doi.org/10.4324/9780203771587
24. Kılınç F, Özen G. *Elit serbest ve grekoromen güreşçilerin anaerobik güç değerlerinin ve kalp atım sayılarının karşılaştırması* [Comparison of anaerobic power values and heart rate of elite freestyle and Greco-Roman wrestlers]. *İnönü Üniversitesi Beden Eğitimi ve Spor Bilimleri Dergisi,* 2015;2(2): 21–34. (In Turkish).
25. Maria Lopez-Gullon J, Muriel X, Dolores

Torres-Bonete M, Izquierdo M, Garcia-Pallares J. Physical fitness differences between Freestyle and Greco-Roman elite wrestlers. *Archives of Budo*, 2011;7(4):217–25.
26. Abellán A, Pallarés J, Gullón J, Otegui X, Baños V, Moreno A. Anaerobic factors to predict wrestling performance. *Cuadernos De Psicología Del Deporte*, 2010;10:17–23.
27. Demirkan E, Koz M, Kutlu M, Özal M, Güçlüöver A, Favre M. The investigation of relationship between the body composition and arms-legs anaerobic performance in adolescent elite wrestlers. *Medicina Dello Sport*, 2013;66(4):513–21.
28. Zi-Hong H, Lian-Shi F, Hao-Jie Z, Kui-Yuan X, Feng-Tang C, Da-Lang T, et al. Physiological profile of elite Chinese female wrestlers. *The Journal of Strength & Conditioning Research*, 2013;27(9):2374–95. https://doi.org/10.1519/JSC.0b013e31827f543c
29. Cieśliński I, Gierczuk D, Sadowski J. Identification of success factors in elite wrestlers-An exploratory study. *Plos One*, 2021;16(3):e0247565. https://doi.org/10.1371/journal.pone.0247565
30. Gierczuk D, Bujak Z, Cieslinski I, Lyakh V, Sadowski J. Response time and effectiveness in elite greco-roman wrestlers under simulated fight conditions. *The Journal of Strength & Conditioning Research,* 2018;32(12):3433–40. https://doi.org/10.1519/JSC.0000000000002868
31. Mirzaei B, Curby DG, Barbas I, Lotfi N. Differences in some physical fitness and anthropometric measures between Greco-Roman and freestyle wrestlers. *International Journal of Wrestling Science*, 2013;3(1):94–102. https://doi.org/10.1080/21615667.2013.10878973
32. Gierczuk D, Lyakh V, Sadowski J, Bujak Z. Speed of reaction and fighting effectiveness in elite Greco-Roman wrestlers. *Perceptual and Motor Skills*, 2017;124(1):200–13. https://doi.org/10.1177/0031512516672126
33. Baić M, Sertić H, Starosta W. Differences in physical fitness levels between the classical and the free style wrestlers. *Kinesiology*, 2007;39(2.):142–9.

Information about the authors:

Gokhan Deliceoğlu; https://orcid.org/0000-0001-8650-3538; deliceoglugokhan@gmail.com; Faculty of Sport Sciences, Coaching Training Department, Gazi University; Ankara, Turkey.

Erkan Tortu; (Corresponding Author); https://orcid.org/0000-0003-2816-9994; erkantortu@trabzon.edu.tr; Faculty of Sport Sciences, Coaching Training Department, Trabzon University; Trabzon, Turkey.

Selman Kaya; https://orcid.org/0000-0002-2185-6436; Selman.kaya@yalova.edu.tr; Faculty of Sport Sciences, Coaching Training Department, Yalova University; Yalova, Turkey.

Cite this article as:
Deliceoğlu G, Tortu E, Kaya S. Comparison of physical performance profiles in freestyle and Greco-Roman wrestlers. *Physical Education of Students,* 2022;26(6):280–287.
https://doi.org/10.15561/20755279.2022.0602

Received: 23.10.2022

Accepted: 24.11.2022; **Published**: 30.12.2022