

## Influence of sports asymmetry and ambidexterity of ground wrestling on the level of competitive performance of Greco-Roman style wrestlers.

ROMAN NAGOVITSYN<sup>1</sup>, SVETLANA ZHUIKOVA<sup>1</sup>, NIKOLAY KONDRATIEV<sup>1</sup>, ALEKSANDER OSIPOV<sup>2,3,4</sup>, TATYANA ZHAVNER<sup>2</sup>, ANNA VAPAEVA<sup>2</sup>

<sup>1</sup>Glazov State Pedagogical Institute named after V.G. Korolenko, Glazov, RUSSIA

<sup>2</sup>Siberian Federal University, Krasnoyarsk, RUSSIA

<sup>3</sup>Krasnoyarsk State Medical University named after professor V.F. Voyno-Yasenetsky, Krasnoyarsk, RUSSIA

<sup>4</sup>Siberian Law Institute of the Ministry of Internal Affairs of the Russian Federation, Krasnoyarsk, RUSSIA

Published online: December 31, 2018

(Accepted for publication December 12, 2018)

DOI:10.7752/jpes.2018.04370

**Abstract:** In our studies, the purpose of our research was to determine the level of dependence of the competitive results of Greco-Roman wrestlers with their ability to realize technique in the ground wrestling in different directions. Actually the participants of the research are the athletes (n = 160) with different sports qualifications from the beginners (B) to subelite (S) and elite athletes (High sports mastery (HSM)). Moreover, the athletes were divided into 2 groups: group of athletes with asymmetry (AG) (n=99) – the athletes conducting holds in the ground mainly in one direction and group of athletes with ambidexterity (AmG) (n=61) – the athletes conducting holds both the right and left sides. The study period is 2 years (2015–2016). By the way the competitive results of the athletes were assessed using the rating scale developed by the authors. On average, the number and quality of techniques of the ground wrestling was assessed by the method of competitive matches analyses. Besides the statistical analysis was performed using Student's t-test. Besides, it was revealed that the elementary education athletes (B) performing ground wrestling holds predominantly in one direction so their competitive results are reliable higher (P<0,01). It should be noted that an approximate equality of the competitive results of the subelite athletes (S) is recorded in the group of athletes (AG) and group of athletes (AmG). The level of competitive results of the elite athletes (HSM) is significantly (P<0,01) higher than the wrestlers of the group of athletes (AmG). Indeed, the results show that the ability to conduct holds successfully in the ground in different directions does not have a significant effect on sports results of the athletes at the initial stage of preparation. Fortunately, this ability allows the elite wrestlers to increase the level of sports results significantly.

**Key words:** ground wrestling; versatility; sports results; elite athletes High sports mastery (HSM); wrestlers–ambidexters.

### Introduction

It is known that a wrestling match is not a contest of the athletes in strength and dexterity but it is primarily a battle of wits. Actually the wrestlers who are unable to orient quickly in the dynamically changing conditions of competitive fights will be doomed in the Greco-Roman wrestling to rather modest competitive results (Isaeva, Korshunov, Leonov, et al., 2016). It's well known that only the athletes who can quickly and accurately make the right decisions (Drid, Drapsin, Trivic, et al., 2009) are able to achieve outstanding results in martial arts. F. Kiyicia argues that only the wrestlers possessing the ability of technical symmetry – equally successful execution of techniques in different directions – can choose the most preferable tactical variant of conducting competitive duels and achieve victories (Kiyicia, & Ucan, 2014). According to many works by the Russian and foreign scientists have been devoted to the problems of sport asymmetry and ambidextrism (Sychev, Davydova, & Kashkarov, 2017; Drid, Drapsin, Trivic, et al., 2009; Aganyants, Berdichevskaya, Gronskaya, et al., 2004). Specialists recommend paying attention to planning the training process at the initial stage of training on the ability of the athletes to master the right and left extremities equally and successfully (Zivagil, & Bayram, 2014). It has been proved that in many sports such as: martial arts, sports games and gymnastics the versatile athletes – persons who are equally and successfully operating both limbs when moving to the right or to the left they have a significant advantage over the asymmetrical athletes (Korobeynikov, & Korobeynikova, 2014 Gursoy, 2009).

In any case the modern level of contention-based competition in martial arts dictates the need to improve the training process in order to improve the level of sport results of the wrestlers (Osipov, Kudryavtsev, Iermakov, et al., 2017). In full measure, this statement applies to the Greco-Roman wrestling. Unfortunately, in the process of training Greco-Roman style wrestlers, many trainers have an orientation to the accelerated development of special psychophysical qualities and tactical and technical preparedness without taking into

account the individual physiological characteristics of the athletes that somewhat reduces the effectiveness of training influences (Nagovitsyn, Volkov, Miroschnichenko, et al., 2017). At the same time, this circumstance is especially evident in the transition of the athletes from the elementary training groups (B) to the sports perfection groups (S) and the beginning of the wrestling performances in the international arena. Moreover, the specialists recommend training highly qualified athletes in the Greco-Roman wrestling on the basis of developing the versatility of the wrestlers and developing their ability to carry out a variety of techniques in the ground (Stradijot, Pittorru, & Pinna, 2012).

Indeed, we analyzed the scientific literature devoted to the problem of improving the methods of training in the Greco-Roman wrestling and other types of martial arts. At the same time, it has been revealed that there are several methods of increasing the level of sports mastery of the athletes. Besides, the specialists from the post-Soviet countries mostly recommend taking into account the individual age characteristics of the wrestlers (Pogodina, & Aleksanyants, 2017, Portnyagin, Torgovkin, & Nikolaev, 2015) and conduct differentiated tactical and technical training for the athletes taking into account these features (Latyshev, Korobeynikov, 2013; Krikuha, & Shevtsov, 2012). It should be noted that a number of domestic and foreign scientists suggest to take into account the predisposition of the athletes to the active work in different energy regimes during the training activities (Sawczyn, Jagiello, Mishchenko, et al., 2015, Hübner-Wozniak, Kosmol, Lutoslawska, et al., 2004) their anthropometric indices (Khomenko, Antropova, & Kokin, 2017) adjustable dosing of training loads (Nagovitsyn, Volkov, Miroschnichenko, 2017; Osipov, Kudryavtsev, Kuzmin, et al., 2016) and individual characteristics of the training activities (Kozina, Jagiello, V., Jagiello, M., 2015). Also, when planning the training and competitive activity of the martial artists, the specialists propose to take into account the regular keeping of competitive matches by the athletes determined by a detailed analysis of the competitive fights (Adam, & Sterkowicz-Przybycień, 2018; Adolf, Sidorov, Kudryavtsev, et al., 2018; Kajmovic, Kapur, Radjo, et al., 2014). Moreover, the analysis of scientific data showed that the most specialists drew attention to the lack of successful technical actions of the athletes in the fight lying down and invite to strengthening the offensive arsenal of the wrestlers during the delivering competition-based dual meet of the ground wrestling. In this regard, we determined the main goal of the research identifying connection of the sports results on the versatility of realization holds in the ground wrestling of the Greco-Roman style wrestlers of various sports qualifications (from beginners to masters performing in the international competitions).

### Material & methods

Fortunately, the research was carried out on the basis of three specialized sports schools of Greco-Roman wrestling: “Perm Bears” (Perm), “Institute” (Naberezhnye Chelny) and “Progress” (Glazov). The duration of the research is 2 years (2015–2016). The participants of the research are Greco-Roman wrestlers (n = 160) who have an experience of wrestling from 2 to 10 years and have experience of the competitive performances. Sport qualification of the athletes: 70 wrestlers had the athletic ranks (B), 58 wrestlers had the title of candidate for the master of sports of the Russian Federation (S), 32 wrestlers had the ranks: master of sports of the Russian Federation and master of sports of the Russian Federation of the international category (HSM). Specialists have revealed that all athletes gave their consent to participate in the research. Also, the research was carried out in two stages. During the first stage (2015), all athletes were divided into 2 groups according to the technique of performing holds in the ground wrestling and the direction of the majority of holds (on the right or left side). The division of the athletes into groups occurred on the basis of an objective analysis of competitive performances by the athletes using videotapes of the competitive matches. By the way the number and quality of technical actions performed by the athletes in the ground wrestling was assessed. The group of athletes with asymmetry (AG) (n = 99) included wrestlers the most of whom performed holds in the ground wrestling mainly in one (right or left) side. Accordingly, the group of athletes with ambidexterity (AmG) (n = 61) included the athletes who performed technical actions in the ground evenly both to the right and to the left. In the second stage (2016), the performance indicators of the wrestlers of these groups were determined at the competitions of various levels. For the qualitative determination of the performance indicators of the group athletes with asymmetry and ambidexterity the rating scale developed by the authors was used. It should be noted that the points were awarded to the wrestlers for the winning placements at the competitions of various levels (from urban to national). The scale of rating points is presented in Table 1.

Table 1. The evaluation scale of the competitive results of the group athletes with asymmetry and ambidexterity taking part in the research.

Result	Result
2-3 placement in the city competition -1 point	1 placement in the competition of Volga Federal Region – 8 points
1 placement in the city competition – 2 points	4-6 placement in the competition of Russian Federation – 9 points
2-3 placement in the competition or championship of the republic or region – 3 points	2-3 placement in the competition of Russian Federation – 10 points

1 placement in the competition or championship of the republic or region – 4 points	1 placement in the competition of Russian Federation – 11 points
2-3 placement in the competition of Volga Federal Region– 5 points	4-6 placement in the competition of Russian Federation – 12 points
2-3 placement in the competition of Volga Federal Region – 6 points	2-3 placement in the competition of Russian Federation – 13 points
1 placement in the competition of Volga Federal Region – 7 points	1 placement in the competition of Russian Federation – 14 points

However, it should be noted that the statistical processing of the results of the studies was carried out using the statistical analysis program SPSS20. Student's t-test was used to analyze the data obtained during the research quantitatively.

## Results

According to the results of the first stage of the analysis of the performance of the wrestling techniques in the mat the athletes from Greco-Roman wrestling schools qualifying as elementary education (B) (n=70) were divided: “Perm Bears” - The group of athletes with asymmetry (AG) – 13 and the group of athletes with ambidexterity (AmG) – 10; “Institute” – The group of athletes (AG) – 11 and the group of athletes (AmG) – 7; “Progress” – The group of athletes (AG) – 21 and the group of athletes (AmG) – 8. The athletes were engaged in these schools and qualified – subelite athletes (S) (n=58) were divided into: “Perm bears” – The group of athletes (AG) – 10 and the group of athletes (AmG) – 8; “Institute” – The group of athletes (AG) – 17 and the group of athletes (AmG) – 9; “Progress” – The group of athletes (AG) – 9 and the group of athletes (AmG) – 5. Thus, the wrestlers with qualifications - High sports mastery (HSM) (n=32) is divided into: “Perm Bears” – The group of athletes (AG) – 6 and the group of athletes (AmG) – 8; “Institute” – The group of athletes (AG) – 7 and the group of athletes (AmG) – 3; “Progress” – The group of athletes (AG) – 5 and the group of athletes (AmG) – 3.

Luckily, the results of the research indicate that in the elementary education groups (B) the advantage in the competitive performance among the group of athletes (AG) is revealed. For the athletes from the school "Perm Bears" this advantage does not have highly reliable differences. At the same time, the fighters from the schools “Institute” and “Progress” revealed a significant ( $P<0,01$ ) advantage in the competitive results in favor of the athletes with the predominant performance of holds in the ground wrestling in any one direction.

It should be noted that in the subelite athletes (S) groups the approximate equality in the competitive results among the group of athletes (AG) and the group of athletes (AmG) from schools “Perm Bears” and “Institute” was found. Statistically significant ( $P<0,01$ ) differences were revealed among the athletes from the school “Progress” in favor of the group of athletes (AmG).

By the way the results of competitive activity among the athletes from the High sports mastery groups significantly ( $P<0,01$ ) differed in favor of the group of the athletes (AmG) in all Greco-Roman wrestling schools.

It turned out that the statistical results of the studies of the level of sports performance of the group of athletes (AG) and the group of athletes (AmG) are presented in Table 2.

Table 2. Comparative data of sports results of the wrestlers

Qualification of the wrestlers (n = 160)	«Perm bears»		«Institute»		«Progress»	
	the group of athletes (AG)	the group of athletes (AmG)	the group of athletes (AG)	the group of athletes (AmG)	the group of athletes (AG)	the group of athletes (AmG)
Elementary education (B) (n=70)	2,38±0,12	1,91±0,16	3,73±0,15*	2,86±0,51	4,67±0,08*	3,63±0,05
Subelite athletes (S) (n=58)	8,40±0,34	8,25±0,47	7,94±0,32	7,67±0,29	6,56±0,21	7,40±0,36*
High sports mastery (HSM) (n=32)	15,17±0,09	17,38±0,18*	10,29±0,63	13,33±0,47*	8,20±0,87	10,02±0,49*

Reliability - \* -  $P<0,01$ .

Moreover, the results of the ratio of the average values of the competitive performance of the group of athletes (AG) (n=99) and the group of athletes (AmG) (n=61) for the period of research are presented in Fig. 1.

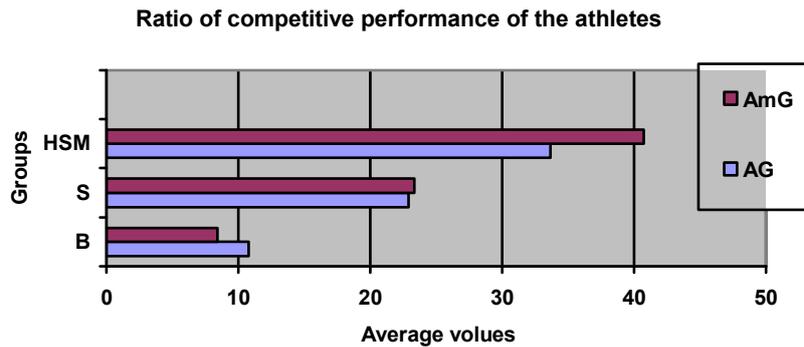


Fig. 1.

## Discussion

Nevertheless, in the scientific literature there are data on the competitive advantage of the elite wrestlers over the less-trained athletes and amateur wrestlers (Gierczuk, Lyakh, Sadowski, et al., 2017; García-Pallarés, López-Gullón, Muriel, et al., 2011) from the young age (Demirkan, Koz, Kutlu, et al., 2015). However, there is a shortage of scientific papers devoted to determining the factors contributing to the increase in the competitive performance of the elite athletes in a highly competitive environment (Latyshev, Latyshev, Kvasnytsya, et al., 2017). As applied to the Greco-Roman wrestling, the authors found that among the elite wrestlers the ambidexter athletes (who have the ability to conduct holds in the ground wrestling is equally well both to the right and to the left) have a higher level of competitive performance than the athletes performing the methods of the ground wrestling predominantly in one (right or left) side.

Unfortunately, the most specialists do not pay their attention to these technical and physiological characteristics of the wrestlers. In the scientific literature, we were able to find only one study concerning the relationship between the symmetric and asymmetric methods of training the fighting techniques (Vračan, Baić, & Starčević, 2017). Moreover, this study was conducted only with the wrestlers-beginners and did not affect the wrestlers of the higher sports qualification. By the way there are studies that reveal the specifics of the practice of performing various methods of fighting athletes in different directions. However, in these works we are talking about either beginners-wrestlers (Iglesias-Soler, Mayo, Dopico, et al., 2018) or about the wrestlers with the dominant right (right-handed) or left (left-handed) sides of the body (Ziyagil, Gursoy, Dane, 2010). Besides the analysis of the scientific publications shows that the most of the studies of physical fitness and physiological profile of the successful wrestlers are devoted to the accelerated opportunities for the development of aerobic energy, anaerobic power and muscular power (Chaabene, Negra, Bouguezzi, et al., 2017; Nikooie, Cheraghi, & Mohamadipour, 2017). Thus, the peculiarities of the ground wrestling by the Greco-Roman style wrestlers taking into account the technical symmetry and asymmetry of the wrestlers are not given much attention. This seems strange, as the experts note that the opportunity to host a match in the ground wrestling during the competitive match will be given to both wrestlers (Tropin, & Pashkov, 2015). It should be noted that in other types of martial arts, in particular judo, the indicators characterizing the wrestler's activity in the wrestling match are one of the defining criteria for assessing the level of athlete's competitive readiness (Adolf, Sidorov, Kudryavtsev, et al., 2018). Actually the importance of determining the dependence of the sport result on the level of bilateral asymmetry of the athletes in elite sport has been emphasized by the scientists for a long time (Tomkinson, Popović, & Martin, 2003).

## Conclusions

In conclusion, we may say that the studies of the level of competitive performance of Greco-Roman wrestlers showed that the concentration of technical and tactical efforts in the training process on the basis of the development of ambidextrous characteristics of the athletes in the ground wrestling does not contribute to an increase in sports results of the athletes at the initial stage. However, with the growth of sports qualification, the development of ambidextrous characteristics of the wrestlers in the ground wrestling allows to increase significantly the level of sports results of the athletes. A significant ( $P < 0,01$ ) advantage in the level of competitive performance is revealed in the group of athletes (AmG) (group BCM) in all schools of Greco-Roman wrestling. After all the studies related to this issue the use of research results in the process of training Greco-Roman wrestlers will allow the specialists to enter a higher and qualitative level of the training process allowing to ensure the growth of the sports results of the athletes. The scale proposed for assessing the competitive performance of the athletes in rating scores can be used to monitor the training process both in the Greco-Roman wrestling and in other types of martial arts.

**Conflicts of interest** - If the authors have any conflicts of interest to declare.

## References.

- Adam, M., & Sterkowicz-Przybycień, K. (2018). The efficiency of tactical and technical actions of the national teams of Japan and Russia at the World Championships in Judo (2013, 2014 and 2015). *Biomedical Human Kinetics*, 10. 45-52. DOI:10.1515/bhk-2018-0008
- Adolf, V., Sidorov, L., Kudryavtsev, M., et al. (2018). Precompetitive fitness methods applied by Russian judo teams prior to international events. *Teoriya i Praktika Fizicheskoy Kultury*, 9. 66-68.
- Aganyants, E., Berdichevskaya, E., Gronskaya, A., et al., (2004). Functional asymmetries in sports: the place, role and prospects of research. *Teoriya i Praktika Fizicheskoy Kultury*, 8. 22-24. [In Russian].
- Chaabene, H., Negra, Y., Bouguezzi, R., et al. (2017). Physical and physiological attributes of wrestlers: An update. *Journal of Strength and Conditioning Research*, 31(5). 1411-1442. DOI:10.1519/JSC.0000000000001738
- Demirkan, M., Koz, M., Kutlu, M., & Favre, M. (2015). Comparison of physical and physiological profiles in elite and amateur young wrestlers. *Journal of Strength and Conditioning Research*, 29(7). 1876-1883. DOI:10.1519/JSC.0000000000000833
- Drid, P., Drapsin, M., Trivic, T., et al. (2009). Asymmetry of muscle strength in elite athletes. *Biomedical Human Kinetics*, 1. 3-5. DOI:10.2478/v10101-009-0002-1
- García-Pallarés, J., López-Gullón, J., Muriel, X., et al. (2011). Physical fitness factors to predict male Olympic wrestling performance. *European Journal of Applied Physiology*, 111(8). 1747-1758. DOI:10.1007/s00421-010-1809-8
- Gierczuk, D., Lyakh, V., Sadowski, J., & Bujak, Z. (2017). Speed of reaction and fighting effectiveness in elite Greco-Roman wrestlers. *Perceptual and Motor Skills*, 124(1). 200-213. DOI:10.1177/0031512516672126
- Gursoy, R. (2009). Effects of left- or right-hand preference on the success of boxers in Turkey. *British Journal of Sports Medicine*, 43. 142-144. DOI:10.1136/bjism.2007.043547
- Hübner-Wozniak, E., Kosmol, A., Lutoslawska, G., et al. (2004). Anaerobic performance of arms and legs in male and female free style wrestlers. *Journal of Science and Medicine in Sport*, 7(4). 473-480. DOI: 10.1016/S1440-2440(04)80266-4
- Iglesias-Soler, E., Mayo, X., Dopico, X., et al. (2018). Effects of bilateral and non-dominant practices on the lateral preference in judo matches. *Journal of Sports Sciences*, 36(1). 111-115. DOI:10.1080/02640414.2017.1283431
- Isaeva, A., Korshunov, A., Leonov, S., et al. (2016). Quantitative and qualitative indicators of developing anticipation skills in junior wrestling athletes. *Procedia - Social and Behavioral Sciences*, 233. 186-191. DOI: 10.1016/j.sbspro.2016.10.191
- Kajmovic, H., Kapur, A., Radjo, I., & Mekic, A. (2014). Differences in performance between winners and defeated wrestlers in the European championships for cadets. *International Journal of Performance Analysis in Sport*, 14(1). 252-261. DOI:10.1080/24748668.2014.11868719
- Khomenko, R., Antropova, E., & Kokin, V. (2017). Highly-skilled weightlifters pre-competitive training individualization technology. *Teoriya i Praktika Fizicheskoy Kultury*, 9. 70-72.
- Kiyicia, F., & Ucan, I. (2014). The comparison of the wrestlers' status of some physical, physiological and growth hormone status after resting, competition and sauna sessions. *Procedia - Social and Behavioral Sciences*, 116. 19-22. doi.org/10.1016/j.sbspro.2014.01.161
- Korobeynikov, G., & Korobeynikova, L. (2014). Functional brain asymmetry and cognitive functions in elite wrestlers. *International Journal of Wrestling Science*, 4(1). 26-34. doi.org/10.1080/21615667.2014.10878997
- Kozina, Z., Jagiello, W., & Jagiello, M. (2015). Determination of sportsmen's individual characteristics with the help of mathematical simulation and methods of multi-dimensional analysis. *Pedagogics, psychology, medical-biological problems of physical training and sports*, 12. 41-50. <http://dx.doi.org/10.15561/18189172.2015.1207>
- Krikuha, Y., & Shevtsov, A. (2012). Types of different techno-tactical tie-ups used for control in Greco-Roman wrestling. *International Journal of Wrestling Science*, 2(1). 83-89. doi.org/10.1080/21615667.2012.10878948
- Latyshev, M., Latyshev, S., Kvasnytsya, O., et al. (2017). Performance analysis of freestyle wrestling competitions of the last Olympic cycle 2013–16. *Journal of Physical Education and Sport*, 2. 590-594. DOI:10.7752/jpes.2017.02089
- Latyshev, S., & Korobeynikov, G. (2013). Approach of the systems to problem of individualization of training of fighters. *Physical Education of Students*, 5. 65-68. DOI: <http://dx.doi.org/10.6084/m9.figshare.771109>
- Nagovitsyn, R., Volkov, P., Miroshnichenko, A., et al. (2017). The influence of special graduated weight load in Greco-Roman wrestling on the growth of students' sports results. *Physical education of students*, 21(6). 294-301. DOI:10.15561/20755279.2017.0606

- Nagovitsyn, R., Volkov, P., & Miroshnichenko, A. (2017). Planning of physical load of annual cycle of students', practicing cyclic kinds of sports, training. *Physical Education of Students*, 21(3). 126-133. DOI: 10.15561/20755279.2017.0305
- Nikooie, R., Cheraghi, M., & Mohamadipour, F. (2017). Physiological determinants of wrestling success in elite Iranian senior and junior Greco-Roman wrestlers. *Journal of Sports Medicine and Physical Fitness*, 57(3). 219-226. DOI:10.23736/S0022-4707.16.06017-5
- Osipov, A., Kudryavtsev, M., Iermakov, S., & Jagiello, W. (2017). Topics of doctoral and postdoctoral dissertations devoted to judo in period 2000-2016 – the overall analysis of works of Russian experts. *Archives of Budo*, 13. 1-10.
- Osipov, A., Kudryavtsev, M., Kuzmin, V., et al. (2016). Methods of operative and informative control of the muscle loading level used during the training of sambo wrestlers. *Journal of Physical Education and Sport*, 4. 1247-1252. DOI:10.7752/jpes.2016.04198
- Pogodina, S., & Aleksanyants, G. (2017). Adaptation and functional condition of highly skilled athletes in the age and sex aspects. *Teoriya i Praktika Fizicheskoy Kultury*, 10. 72-74.
- Portnyagin, I., Torgovkin, V., & Nikolaev, N. (2015). Individualization of training process of student-freestyle wrestlers. *Teoriya i Praktika Fizicheskoy Kultury*, 10. 29-30.
- Sawczyn, S., Jagiello, W., Mishchenko, V., & Fetisov, V. (2015). Dependence of work capacity recovery after strenuous training sessions upon individual predisposition of skilled wrestlers to work under different energy modes. *Archives of Budo*, 11. 197-207.
- Stradijot, F., Pittorru, G., & Pinna, M. (2012). The functional evaluation of lower limb symmetry in a group of young elite judo and wrestling athletes. *Isokinetics and Exercise Science*, 20(1). 13-16. DOI:10.3233/IES-2011-0434
- Sychev, V., Davydova, S., & Kashkarov, V. (2017). Functional asymmetry in sport. *Teoriya i Praktika Fizicheskoy Kultury*, 11. 69-71.
- Tomkinson, G., Popović, N., & Martin, M. (2003). Bilateral symmetry and the competitive standard attained in elite and sub-elite sport. *Journal of Sports Sciences*, 21. 201-211.
- Tropin, Y., & Pashkov, I. (2015). Features of competitive activity of highly qualified Greco-Roman style wrestler of different manner of conducting a duel. *Pedagogics, psychology, medical-biological problems of physical training and sports*, 3. 64-68. DOI:<http://dx.doi.org/10.15561/18189172.2015.0310>
- Vračan, D., Baić, M., & Starčević, N. (2017). Ambidexterity and performance in wrestling. *Acta Kinesiologica*, 11(Supplement Issue 2). 12-16.
- Zivagil, M., & Bayram, L. (2014). Relationships among hand dominance, competition success rankings and isometric elbow and knee strength in prepubertal novice wrestlers. *International Journal of Wrestling Science*, 4(2). 19-27. DOI:10.1080/21615667.2014.954487
- Ziyagil, M., Gursoy, R., Dane, S., & Yuksel, R. (2010). Left-handed wrestlers are more successful. *Perceptual and Motor Skills*, 111. 65-70. DOI:10.2466/04.05.19.25.PMS.111.4.65-70