

Physical fitness of highly qualified female and male wrestlers of various sports levels

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Abstract:

Research on studying fitness preparation in wrestling in the context of fighting style, gender and weight category can provide valuable tips for training work. There is a small number of scientific publications in which an attempt was made to determine the physical fitness of highly qualified female and male wrestlers. The deficit of scientific studies taking into account the fitness profile is particularly noticeable in women's wrestling. The aim of the study was to determine the physical fitness of female and male freestyle wrestlers (both men and women) of various levels of sports advancement. Highly qualified female and male freestyle wrestlers in the junior and senior age categories took part in the study. Due to body weight, the female and male competitors were divided into two conventional groups: light and heavy ones. The tests included the assessment of physical fitness, taking into account: explosive power, strength endurance, agility, flexibility and special endurance. The level of sports advancement, weight category and gender differentiate the physical fitness of highly qualified male and female freestyle wrestlers. Seniors of lightweight categories are characterized by higher values of special endurance than juniors of similar body weight. When divided into two weight categories, only in the case of male freestyle wrestlers in the senior category, differences in favor of competitors from lighter weight categories were visible in flexibility. Comparing physical fitness by gender, men dominated in explosive power, strength endurance, agility and special endurance, however women dominated in flexibility. The physical fitness of highly qualified female and male wrestlers varies according to the level of sports advancement, gender and weight category. Training groups at various stages of sports advancement should be created according to gender and weight category. In the motor preparation of female and male wrestlers of all weight categories, the leading components of physical fitness different for a particular gender should be emphasized in the first place. This should be taken into account in the selection of training measures aimed at specific components of physical fitness among female and male wrestlers.

Key Words: Wrestling, Fitness profiles, Sports advancement

Introduction

Attractiveness of a wrestling fight and its place in the system of Olympic competition contributed to generating interest of researchers in broadly understood issues of training in this sport. Practitioners and theorists of wrestling-related training constantly search for new and more effective ways and methods of training female and male wrestlers and conducting a sports fight. The issue of identifying effective means and methods of training at various sports levels lies within the scope of scientific enquiry. All this research is carried out to optimize the process of sports training and, consequently, increase the dynamics of the fight and enhance the attractiveness of wrestling. For a number of years, researchers have been looking for new training solutions taking into account current trends of sports competition. In general, the aim is to develop and to integrate different abilities of an athlete (both inborn and acquired in the course of training) so that they are fully manifested during the main competitions, e.g. World Championships or Olympic Games. Sports results constitute the best indicator of an adopted solution, both with reference to norms (obtained high sports results) and with regard to one's own achievements so far (initial state) [Bampa & Haft, 2009].

One of the most important elements characterizing sports championship in any discipline is physical fitness [Nikooie et al., 2017; Cieslinski et al., 2021; Gierczuk & Sadowski, 2021; Kudryavtsev et al., 2023]. It can be defined as the current ability of the competitor to perform a motor task that requires the involvement of many motor skills, as well as other properties of the body enabling its effective functioning (including the circulatory system, respiratory system, etc.). Physical fitness is particularly important in sports where competitors are divided into weight categories. An example of this is martial arts, where a diverse structure of motor fitness can be observed in athletes of different body weight. Its profile also changes depending on the type of combat sport, gender or sports advancement [García-Pallarés et al., 2012; Bayraktar & Koc, 2017; Gierczuk et al., 2020]. Physical fitness differs among wrestlers who achieve success in sport, and those who are

unsuccessful. The data on the relationship of this type of preparation with sports results can be found in numerous publications [Nikooie et al., 2017; Cieslinski et al., 2021; Gierczuk & Sadowski, 2021]. They show that a high level of motor skills is necessary to achieve sports success in wrestling. Among the leading motor skills authors mention: muscle strength of the upper and lower limbs, speed, agility, motor coordination, special endurance, flexibility and balance. It can therefore be concluded that wrestling is characterized by a comprehensive manifestation of motor skills [Mirzaei et al., 2011]. Success in such a complex sport discipline is primarily determined by their mutual dependencies [Ackland et al., 2009; Mirzaei et al., 2011].

Various tests are used to assess physical fitness in wrestling. They are a popular form of controlling the effects of the training process. They make it possible to compare the level of motor skills of the subject with the best ones, on the basis of which directions of further work of a competitor are indicated [Marković et al., 2022]. Mostly, they consist of several motor tasks aimed at determining the level of strength, speed, endurance, flexibility and motor coordination. These are well-known exercises and do not cause any special difficulties in performing. In the literature, you can find many examples of the use of tests to control the fitness of competitors. Most often, the authors focused on the assessment of physical fitness using various research methods and tools [Deliceoğlu et al., 2022; Özbay & Ulupinar, 2022; Skugor et al., 2023]. This approach considerably makes it much more difficult to determine the fitness profile or identify the leading motor skills and their interrelationships among highly qualified female and male competitors which limits the possibility of their practical use. The diversity, and sometimes even contradiction, of the results presented by different authors is mostly due to different methodological approaches or selection of the subjects.

The motor fitness profile of highly qualified male wrestlers is also the subject to certain modifications as a result of the implementation of modern training technologies or is forced by changes in the rules of sports competitions, etc. [Latyshev et al., 2017; Slacanac et al., 2017]. In addition, many scientific publications are based on research conducted among highly qualified athletes [García-Pallarés et al., 2011; Nikooie et al., 2017; Cieslinski et al., 2021; Özbay & Ulupinar, 2022]. The deficit of scientific publications concerns mainly the physical fitness of female wrestlers of various sports proficiency, and especially female champion level competitors. Men's training patterns are transferred to women's training, as in other martial arts [García-Pallarés et al., 2012]. Women's wrestling is present at official tournaments for much shorter time, which undoubtedly affects the amount of available knowledge necessary to implement effective women's training technologies. Relatively few scientific studies on female wrestlers can only be used as a reference point for further research, but they do not provide basis for unambiguous findings or training rules [García-Pallarés et al., 2012; Arakawa et al. 2015; Yamashita et al., 2017]. For this, experimental research on multi-directional conditions for achieving high sports results is needed, which would allow to shape the fitness profile of female and male wrestlers in the process of multi-stage training [Latyshev et al., 2014; López González, 2014].

Previous research results do not give a satisfactory picture of the motor preparation of female and male wrestlers of various levels of sports advancement, leaving many issues unresolved. There is a lack of holistic approach to solving this problem which would take into account the main components of fitness preparation included in the material structure of training in wrestling. Updating the data allowing for the identification of various, significant indicators of fitness preparation in highly qualified female and male athletes is important for the development of an optimal training program in competitive wrestling. This is especially important in women's wrestling, where the knowledge deficit is felt the most.

In order to meet the above-mentioned problems, the aim of the work was to determine the physical fitness of female and male freestyle wrestlers of various levels of sports advancement.

Materials & Methods

Participants. 64 highly qualified female and male wrestlers in the junior and senior age categories participated in the study. Among them there were 32 female wrestlers and 32 male ones. The age of the competitors in the junior category was 19.13 ± 0.96 years and the training experience was 7.19 ± 1.05 years, and in the senior category it was 23.19 ± 1.56 years with a training experience of 10.31 ± 1.01 years. The average age of the junior female wrestlers was 19.50 ± 1.41 years and the average training experience was 7.50 ± 1.41 years. For seniors, analogically the age of the competitors was 24.5 ± 3.10 years with a training experience of 11.25 ± 3.49 years. The selection of the subjects was based on the classification of the Polish Wrestling Association among the competitors occupying places from 1st to 3rd during the Polish Championships [<https://www.zapasy.org.pl>, 2019]. Due to the body weight of the wrestlers, both men and women were divided into two conventional groups: light and heavy. Taking into account the adopted division, eight groups were created - four individuals of each sex, i.e. eight subjects each. Prior written consent of the participants and current medical certificates of no health contraindications were obtained. Participation in the research was voluntary and preceded by a detailed description of the measurement procedure. Participants concerned received information on the purpose of the research and the ways of using and popularizing the results. The designed measurements were carried out during the preparatory period, as everyone participated in the organized training process. The male and female wrestlers trained 5-6 times a week in training units lasting from 90 to 120 minutes. The Senate Research Ethics Committee of the Academy of Physical Education in Warsaw agreed to carry out the previously planned activities.

Procedure. The physical fitness of male and female wrestlers was determined on the basis of the results of trials and tests most commonly used in the training practice. Eight trials were used for this purpose: standing long jump, pull-ups, bending and straightening the arms in the front support, zigzag run, so-called envelope, rushing up in the wrestling bridge, entering the bridge from above and suplex throws with a dummy [Cieslinski et al., 2021]. The tests included the assessment of motor skills (explosive power, strength endurance, agility, special endurance) and the flexibility.

The measurement procedure was identical for all the subjects. Two days before testing, the female and male competitors did not participate in sports training. Before starting the tests, a standard (20 min.) warm-up was performed for all wrestlers [Cieslinski et al., 2021]. Selected samples were checked for reliability using the "test-retest" method. For this purpose, 15 female wrestlers and 15 male ones were randomly selected. The age of female competitors was 20.87 ± 2.45 years and the training period was 8.53 ± 1.92 years. For men, analogically: 21.53 ± 2.72 years old and the training experience of 9.20 ± 2.83 years. Testing was performed twice with an interval of 5 days. The reliability of the physical fitness tests of female athletes was in the range of 0.81-0.97, and the one of male athletes was 0.78-0.94 [Tables I and II].

Statistical analyses. The results of measurements of fitness indicators were normalized to mean and standard deviations of particular groups of female and male wrestlers. The analysis was performed separately for the female and male contestants of the above-mentioned groups, age and weight categories. Single-factor analysis of variance was used to assess intergroup differences. Differences at the level of $p < 0.05$ were considered significant.

Results

The physical fitness of female wrestlers in the junior and senior age categories and in the division into two weight categories (light and heavy) is presented in Table I. On the basis of the obtained data, differences in the fitness profile of female wrestlers with different levels of sports advancement were observed. Senior women of light weight categories had higher values of special endurance (indicator 8) than junior women of similar body weight ($p < 0.05$).

However, there were no significant differences in individual motor skills between female competitors of different weight categories, both in the junior and senior age categories.

Table I. Physical fitness of female wrestlers of various levels of sports advancement and weight categories (*mean \pm SD*)

Indicator	Retest after 5 days (r)	Female wrestlers			
		Juniors		Seniors	
		Light	Heavy	Light	Heavy
1. Standing long jump (cm)	0.97	201.0 \pm 8.91	211.9 \pm 23.3	212.3 \pm 18.0	226.3 \pm 20.7
2. Pull-ups (number)	0.95	11.75 \pm 1.91	12.25 \pm 3.77	15.88 \pm 3.60	12.87 \pm 4.70
3. Bending and straightening arms in the front support (number)	0.94	41.63 \pm 9.62	44.38 \pm 9.43	41.75 \pm 5.34	45.75 \pm 5.18
4. Zigzag run, so-called envelope (s)	0.88	21.89 \pm 1.46	22.45 \pm 1.59	20.58 \pm 0.95	22.25 \pm 1.38
5. Raising legs in the back hang on the ladders (number)	0.89	26.25 \pm 2.25	26.88 \pm 1.96	28.13 \pm 2.53	28.13 \pm 2.30
6. Rushing up in the wrestling bridge (s)	0.82	9.26 \pm 1.26	10.19 \pm 1.34	9.60 \pm 0.70	11.16 \pm 1.43
7. Entering the wrestling bridge from above with a passage (s)	0.81	5.55 \pm 0.95	6.40 \pm 1.36	5.24 \pm 1.14	6.70 \pm 0.75
8. Suplex throws with a dummy (number)	0.86	37.0 \pm 2.73	41.25 \pm 3.58	44.0 \pm 5.37*	42.0 \pm 3.38

r – Pearson's correlation coefficient; * $p < 0.05$

A different situation occurred among wrestlers, where there were no significant differences in physical fitness among competitors of various sports proficiency ($p > 0.05$) (Table II). Different profiles of physical preparation of wrestlers from light- and heavyweight categories in the senior age category were observed. Lightweight male wrestlers were characterized by higher flexibility values (indicator 7) rather than competitors with larger body weights ($p < 0.001$).

Table II. Physical fitness of male wrestlers of different sports advancement level and weight category (mean±SD)

Indicator	Retest after 5 days (r)	Male wrestlers			
		Juniors		Seniors	
		Light	Heavy	Light	Heavy
1. Standing long jump (cm)	0.92	260.9 ± 16.3	256.1 ± 21.2	256.0 ± 15.8	258.5 ± 21.0
2. Pull-ups (number)	0.94	32.0 ± 9.01	31.38 ± 12.2	37.0 ± 10.4	38.25 ± 7.68
3. Bending and straightening arms in the front support (number)	0.93	59.63 ± 14.6	62.50 ± 13.6	71.88 ± 22.2	73.13 ± 16.2
4. Zigzag run, so-called envelope (s)	0.85	19.29 ± 1.28	20.74 ± 1.79	19.29 ± 1.10	20.15 ± 1.35
5. Raising legs in the back hang on the ladders (number)	0.83	31.0 ± 4.84	32.38 ± 3.62	33.63 ± 2.50	32.50 ± 2.14
6. Rushing up in the wrestling bridge (s)	0.81	10.50 ± 1.38	11.88 ± 1.49	11.15 ± 0.69	12.88 ± 1.23
7. Entering the wrestling bridge from above with a passage (s)	0.78	6.20 ± 1.30	7.19 ± 1.24	5.86 ± 0.74	8.54 ± 1.36***
8. Suplex throws with a dummy (number)	0.89	47.0 ± 6.14	49.63 ± 4.81	51.0 ± 4.60	51.88 ± 3.44

r – Pearson’s correlation coefficient; *** p < 0.001

Greater differences in physical fitness occurred in the breakdown by gender. Data on the differences between female and male wrestlers of various levels of sports advancement and of different weight categories are presented in Figures 1 and 2. In the age category, junior male wrestlers had higher values in most of the assessed abilities than female wrestlers. Male wrestlers of light weight categories, compared to female wrestlers, were characterized by higher values of: explosive power (indicator 1) (p < 0.001), strength endurance (indicator 2 and 5) (p < 0.05-0.001), agility (indicator 4) (p < 0.01) and special strength (indicator 8) (p < 0.001), and heavyweight categories in explosive power (indicator 1) (p < 0.001), strength endurance (indicator 2 and 5) (p < 0.01-0.001) and special strength (indicator 8) (p < 0.01).

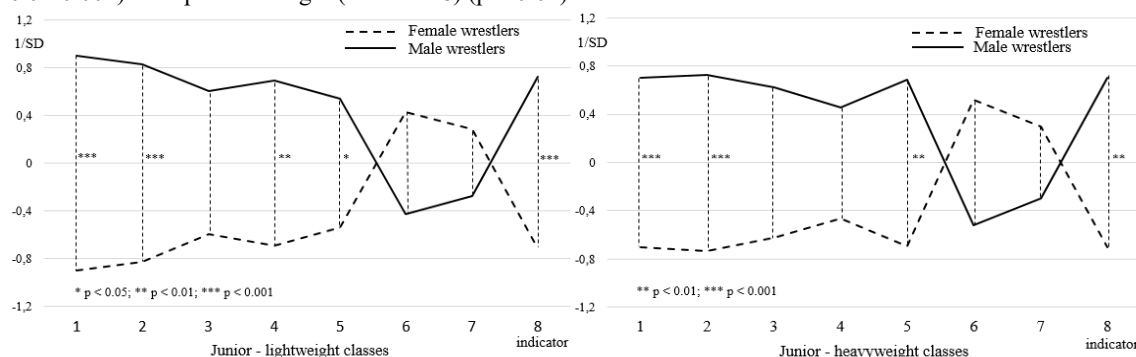


Figure 1. Standardized values of physical fitness indicators of female wrestlers and male wrestlers of the junior age category (normalized for the entire material).

In the case of the senior age category, male competitors of lightweight categories dominated over female competitors with lower body weight in: explosive power (indicator 1) (p < 0.001), strength endurance (indicators 2, 3 and 5) (p < 0.01-0.001) and special strength (indicator 8) (p < 0.05). In heavyweight categories, similarly in: explosive power (indicator 1) (p < 0.05), strength endurance (indicators 2, 3 and 5) (p < 0.01-0.001) and special endurance (indicator 8) (p < 0.001). Female wrestlers, on the other hand, had higher flexibility values (indicator 7) than male competitors (p < 0.05).

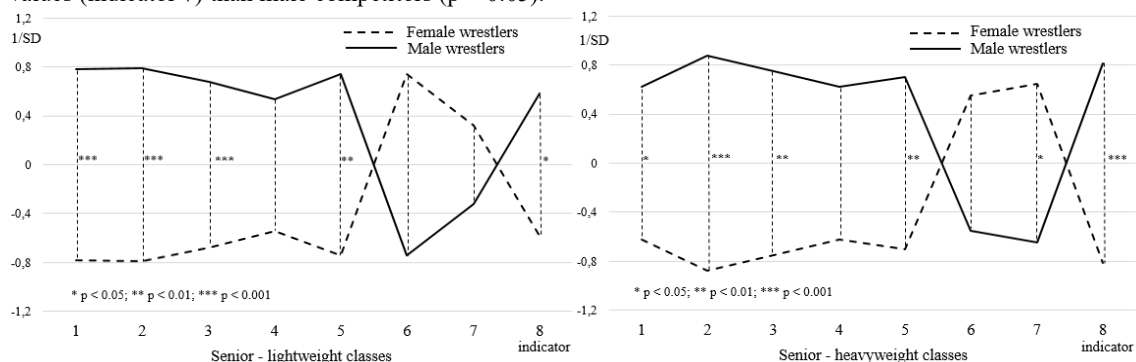


Figure 2. Standardized values of physical fitness indicators of female wrestlers and male wrestlers of the senior age category (normalized for the entire material).

Discussion

The aim of the study was to determine the physical fitness of female and male freestyle wrestlers of various levels of sports advancement. The research concerned the measurement of the leading motor skills in wrestling, i.e. explosive power, strength endurance, agility, special endurance and flexibility. It was revealed that physical fitness is different among women of different levels of sports advancement. These differences occurred mainly among female competitors of lightweight categories and concerned special endurance. Most likely, wrestling match in the senior age category requires not only a higher level of technical and tactical fitness, but also motor skills, which in turn forces a change in the direction and the impact of training loads [Bompa & Haft 2009; Nikooie et al., 2017; Slacanac et al., 2017]. An interesting piece of information is that there is a lack of differences in physical fitness among male competitors of junior and senior age categories. This may be due to similar training loads carried out regardless of the level of sports advancement of competitors.

The results are divided into two conventional weight groups: light and heavy. Thus, different approaches can be found in scientific reports: not taking into account the division based on body weight [Bayraktar & Koc, 2017; Gkrekidis & Barbas, 2017; Sazonov, 2017; Štajer et al., 2017; Özbay & Ulupinar, 2022], with the division into three or more weight categories [Ohya et al., 2015; Casals et al., 2017; Soygüden & Imamoglu, 2017; Deliceoğlu et al., 2022]. It was assumed that the obtained results, taking into account only two groups of weight categories, will have a greater application value. Coaches, working with a specific wrestling community, most often adapt methods, forms, means and training loads in the training process to two groups of competitors, so-called light and heavy ones. Male competitors of medium categories are more labile by weight and repeatedly, consciously or as a result of developmental changes, they increase or decrease body weight, adjusting it to a specific weight category [Sterkowicz-Przybycien et al., 2011]. Comparing the values of individual indicators among the subjects, by division into two weight categories, it can be noticed that there were no significant differences in the fitness profile of female competitors of the light- and heavyweight categories. It was different for freestyle male wrestlers in the senior category. Differences in favor of male competitors of lighter weight categories were visible in flexibility. Opinions on this subject in the literature are divided [Basar et al. 2014; García-Pallarés et al., 2012]. This requires further research, taking into account a number of flexibility conditions.

Comparing the physical fitness of female and male wrestlers, a greater differentiation was noticed, both in terms of fitness and flexibility indicators. The physical fitness of men and women differed in explosive power, strength endurance, agility and special endurance, in which better results were obtained by men. On the other hand, female competitors, according to data from the observations of other researchers, dominated over male ones in terms of flexibility [García-Pallarés et al., 2012]. These differences were mostly visible in the entrance to the bridge from above with a passage. In another test assessing flexibility, i.e. rushing up in the wrestling bridge, no such differences were observed. It should be taken into account that these tests are specific to wrestling and require, in addition to technical skills, also adequate energy effort, in contrast to typical tests, usually performed in static conditions, assessing the morphological and functional property, which is flexibility. The specificity of the anatomical structure and physiological conditions in this case have a significant impact on the results of exercise tests [García-Pallarés et al., 2012].

An important finding of the research was the determination of the fitness profile in the context of the sports level and weight category. On the other hand, a greater differentiation of indicators was observed in relation to gender. Regardless of the data obtained, wrestling practiced by both women and men has its own specificity, which indicates the need for a different training approach. For example, more emphasis should be placed on shaping explosive power, strength endurance, agility or special endurance in athletes, and the development of flexibility among competitors of lightweight categories. The benefits and impact of using specific wrestling exercises on physical fitness, not only in competitive sports, are also appreciated by other authors [Balushka et al., 2020; Griban et al., 2021].

Despite a great deal of information obtained regarding the fitness preparation of highly qualified female and male wrestlers, a number of issues remains open and requires further scientific penetration. Further research should be focused on the development of fitness profiles in the context of fighting style, gender and sports advancement of competitors who are successful in the international arena. More numerous and more polarized groups of athletes in terms of body weight will probably reveal significant differences and allow for more precise development of fitness profiles. Due to the specificity of the sports competition in wrestling, analyses which take into account the weight categories have greater practical value in which sports competitions take place [Latyshev et al., 2017; Slacanac et al., 2017]. The research conducted in the field of other types of competitor's preparation (technical, tactical, psychological, etc.), especially in the context of sports results at major top-level competitions, can contribute to the development of more reliable criteria for identifying sports talent and indicate effective training solutions taking into account individual characteristics of male and female athletes [Rutkowska et al., 2020].

Another interesting issue may be an attempt to build a model fitness profile of a competitor based on a number of variables that are most often considered significant in the context of sports performance. They could be scaled for wrestlers of various levels of sports advancement, which would make it possible to track changes in the profiles along with the increase in the sports level of the subjects. This is connected with the possibility of

creating an analytical and practical scheme, allowing for effective modelling of indicators of fitness preparation of various wrestling gender, and then monitoring them in the training process. It seems possible because there have already been advanced tools that make building such models measurably easier, e.g. **cutting-edge machine learning algorithms** or artificial intelligence ones, which are increasingly becoming widespread in many fields. Another promising research area is the problem of constructing such tests or tools by which it will be possible to monitor the effectiveness of the training process more and more accurately.

Conclusions

The physical fitness of highly qualified female and male wrestlers varies according to the level of sports advancement, gender and weight category. Training groups at various stages of sports advancement should be created according to gender and weight category.

In the motor preparation of female and male wrestlers of all weight categories, the leading components of physical fitness should be emphasized in the first place, e.g. special endurance should be developed in senior female wrestlers of lightweight categories, while flexibility should be trained in senior male wrestlers of lightweight categories. The identification of specific components of physical fitness common to and differentiating the fitness preparation of female and male wrestlers of various levels of sports advancement and weight category may be the basis for rationalizing the process of sports training in the field of motor preparation. This should be taken into account in the selection of training measures aimed at specific components of physical fitness among female and male wrestlers.

Conflicts of interest - The authors declare no conflicts of interest.

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