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Original Article

Pace of performance enhancement and its effect on sports career (on the example of weightlifting)

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Abstract.
In international weightlifting competitions, athletes are allowed to participate from the age of 15 years. Participation in the Youth Olympic Games is allowed for athletes not older than 18 years. How does the early achievement of high competitive results affect the future career of weightlifters?The study deals with the dynamics of the competitive results of young weightliftersdepending on age and weight. The study itself is based on a theoretical analysis of documents and databases, a statistical analysis of weightlifting competitions protocols. Modern training methods allow weightlifters to achieve maximum results from the age of 18 years. However, a significant part of young weightlifters is injured or disqualified for doping. Maximum results in adolescence are typical for Southeast Asia (lightweight) and the Near East (heavyweight). Weight growth with the transition between weight categories is a prerequisite for sustainable progress.There is achange in the age limitsin terms of achieving maximum results and maintaining these achievements. Individual weightlifters can demonstrate a gradual increase in results achieving their maximum at the age of more than 30 years.It has been established that, in weightlifting, the age limits of achieving maximum results and maintaining these achievements have significantlychanged.
Key words: weightlifting, juniors, competitive results.

Introduction.

Today, weightlifting competitions are held for young athletes from the age of 10, national championships start at the age of 13, and official international competitions begin for 15-year-old athletes. In this regard, the paper deals with the effect of an early career on achieving maximum results and the analysis of rational training for young weightlifters to ensure their competitiveness in adolescence.

In the twentieth century, the age of beginning weightlifting training ranged from 13 to 20 years. However, there was a significant decrease in the age limits accompanied by an increase in sports performance and changes in long-term training (Bulgakova, 2017; Dvorkin, 2001). At the same time, there are arguments against early training and accelerated achievements (Oleshko, 2005). Many studies emphasize the need to consider the specific socio-economic circumstances in which young athletes are trained (Cherepov, Kalugina, Khafizova, 2019; Galan, Zoriy, Briskin, Pityn, 2016; Cinar, Talaghir, Abkulut, Turgut, Sarıkaya, 2017). V. Platonov and N. Bulgakova opposed early training and accelerated achievements long before the accepted model of the age limits(Bulgakova, 2017; Platonov, 2013). Weightlifters' career is quite limited in time, and declines inathletic performance occur faster than in other sports (Platonov, 2013). At the same time, there are effective techniques that extend athletic career and ensure recovery from injuries (Wright, Middleton, 2018).

Aim. The paperaims to study the dynamics of the competitive results of highly skilled weightlifters depending on their age, weight dynamics and national schools.

The following tasks are to be solved through the study:

1. To determine the dynamics of the competitive results of weightlifters.
2. To determine the correlation between competitive results and weight changes in highly skilled weightlifters.
3. To determine the age-related features of athletes of different national teams and different weight categories.

Materials and methods.

In the course of the study, the following methods were used: theoretical analysis and generalization of data from scientific and methodological literature, databases, as well as statistical analysis of weightlifting protocols for 2010-2019(World and European Championships, Olympic Games, national championships of Russia and Ukraine). The individual indicators of competitive results (including weight sum in kg and the place), as well as weight and age of individual weightlifters were investigated. The athlete's age was determined at the

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time of the competition in years in decimal system with an accuracy of one hundredth. For this, the following formula was used: date of birth minus date of competition in Excel date format divided by 365.25. For example: (14.07.1985-15.08.2016) / 365.25 = 31.09. In total, 3752 competitive results of young male athletes, juniors and adult athletes were analyzed.

Results and discussion.

Weightlifting has undergone significant transformations over the past decades. In 2018, for the third time in 20 years, weight categories were changed, as well as the algorithm of the Olympic qualification and the assessment of individual achievements. Moreover, extremely stringent anti-doping measures have been taken. The number of countries whose representatives are able to participate in the most prestigious competitions in weightlifting has also expanded significantly.

The object of the study was the dynamics of the results of weightlifters of various weight categories, winners of a number of international competitions. Athletes represent different national teams, and the dynamics of their results was determined by the set of dominant traditions and approaches inherent in the leading national schools of weightlifting. Therefore, significant differences are possible both in the age of achieving the best results and in the duration of maintaining these results (Tovstonog, 2017; Aksenov, Ilyin, 2017; Huebner, Perperoglou, 2019; Solberg, Hopkins, Paulsen, Haugen, 2019).

Modern databases make it possible to trace the dynamics of the results of weightlifters participating in international competitions, reflect their achievements at national competitions(International Weightlifting Results Project. Weightlifting Database, 2019, International Weightlifting Federation.Results by Events, 2019). Most of the scientific research was dedicated to determining the optimal age for the highest results and establishingan increase in the results of young athletes (Dvorkin, 2001; Oleshko, 2005; Ebada, 2011).

The dynamics of nine weightlifters who won the largest number of medals at the Olympic Games and World Championships over the past three decades was used as an example of individual career. The highest career result in international competitions was considered as 100% regardless of the weight category. Three athlete were able to progress at the age of over 30 by changing their weight categories (MutluHalil, Weller Ronny, Sarkisyan Yurik). The average age for achieving the highest result for these athletes is 26.6 ± 3.9 years.However,when it comes to the age of the highest achievements for the category in which they competed most often, the average age is 23.2 ± 1.6 years. Five out of nine the above-named athletes could not be classified at their last competitions. Three-time Olympic champions from Greece - Dimas Pyrros and KakiasvilisAkakios - tried to win the title for the fourth time at the XXVIII Olympic Games but could not overcome this obstacle. Dimas Pyrros won bronze and has the largest number of Olympic awards, and KakiasvilisAkakios, being 35 years old at the time of the competition, did not cope with the starting weight and was left out of qualification.

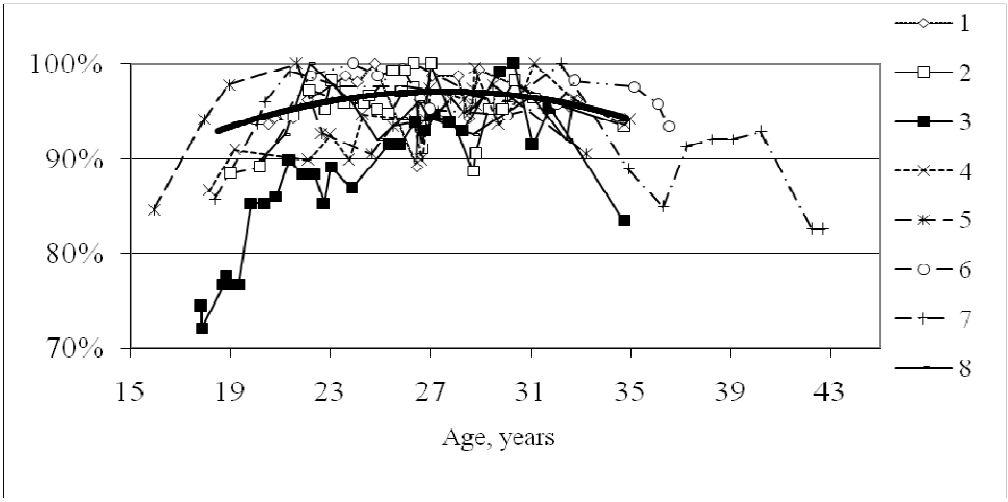

Fig. 1. Age dynamics of the results of the best weightlifters in the world at the end of the XX - beginning of the XXI century
(1 - Dimas Pyrros, 2 - KakiasvilisAkakios, 3 - MutluHalil, 4 - Weller Ronny, 5 - SuleymanogluNaim, 6 - Khrapaty Anatoli, 7 - Sarkisyan Yurik, 8 - Vlad Nicu 9 - Zhan Xugang, solid line - polynomial trend)

The average distribution of male weightlifting world championships participants by age, weight and competition resultsis shown in Fig. 2. According to the age distribution curve, most participants belong to the age group from 22 to 24 years.However, the best results are achieved by athletes aged from 24 to 28 years. Personal weight changes slightly: high values are observed in the age group over 32 years – 89.6 kg. In the age

group over 32 years, despite an average ranking of 17.5, there was a large number of unsuccessful performances. Among the participants of the world championships and Olympic Games, whose age exceeded 30 years, the number of athletes who failed qualification reached 40%. In the age group over 35 years, 50% of participants were unable to lift their initial weights. With age, athletes are exposed to more injuries, which are more frequent and do not allow them to compete fully. AverageageofChampions is24.8 ± 5.5 years.

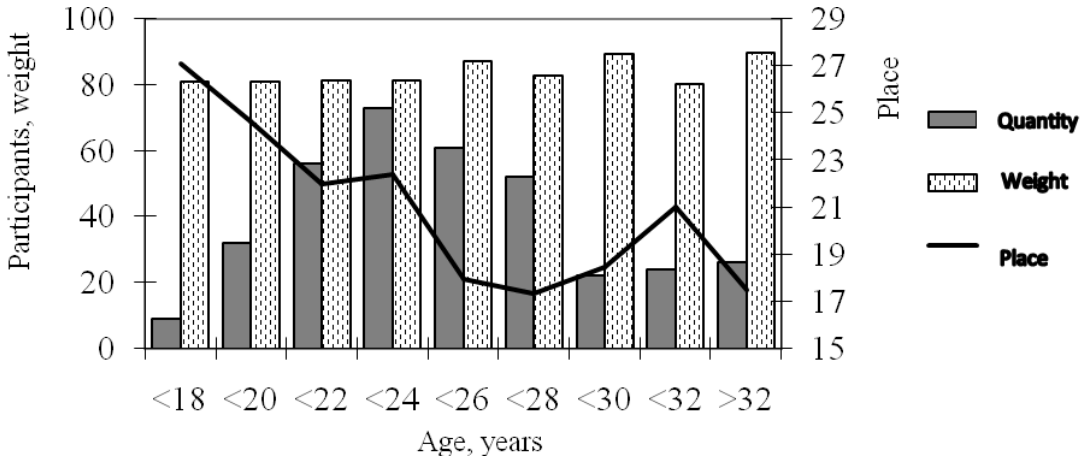

Fig. 2. Distribution of weightlifting world championships participants by age, body weight, place taken

Weightlifters from different national teams demonstrate different rates of development of sports performance. Athletes from China, who successfully perform traditionally in the lightweight and middleweight categories, demonstrate an extremely wide age range of both achieving and maintaining the maximum results. For example, Long Quingquan won the Olympic Games for the first time at the age of 17.7 years.The next Olympic Games he won eight years later in the same weight category of up to 56 kg. At the same time, there are examples of a more gradual progress in the results of Chinese athletes. Lu Xiaojunwon 2004 world Junior Championships in the weight category of up to 69 kg, then moved on to the next weight category of up to 77 kg andseven times won awards at the world championships and Olympic Games. At the 2019 world championships, he again set world records competing in the category of up to 81 kg.At the same time, his age itself is also a record for world weightlifting champions (35.45 years).

A long-term sports career with a gradual increase in results is characteristic of Colombian weightlifters: Figueroa Mosquera became the winner of the Olympic Games in 33.3 years and continues his sports career. Urrutia Maria won the Olympic Games in 35.5 years, which was an age record for the weight categories of the time. However, the growing popularity of weightlifting on the American continent has led to the emergence of a number of 17-year-old athletes who can compete with adult athletes. Lopez LopezYeison born in 1999 brilliantly won a number of competitions in 2015-2017 including junior and cadet world championships.However, in 2018, he was disqualified for four years.

The best athletes of the US team also quickly achieved high results. Cummings Clarence (69 kg, born in 2000) is already a two-time winner of the 2016-2017 cadet world championships and the 2016-2019 Junior world championships. Maurus Harrison (77 kg) won the Junior world championships at 17 years and is the only US winner of the world championships for the last 20 years. However, the increase in his own weight at the competition was only 5.4 kg, which also limited progress in the results.

The athletes who became prize-winners of the XXXI Olympic Games in the middleweight categoriesincreased their own weight after changing two weight categories and gradually improving the results. The results of Iraqi weightlifting stars also gradually improved, most of Iraqi weightlifters had not yet demonstrated high results in their junior age, but overcome competitors as adults.

Athletes who became prize-winners at these competitions and participated in European Championships appear in the databases from the age of 16 and belong to three heavyweight categories. StraltsouVadzim and DidzbalisAurimas, who won the XXXI Olympic Games, performed for the first time at international competitions in the weight category of up to 77 kg and reached the Olympic pedestal in the weight category of up to 94 kg. Moradi Sohrab from Iran became the champion in this category. He also debuted at international competitions in the weight category of up to 77 kg. Moradi Sohrabwas 22nd at the world championship at the age of 19, changed two weight categories in the same way and became the champion of the Olympic Games at the age of 27.9 years, and a year later - the best athlete of the 2017 World championships. At the same time, in 2018, another Iranian athlete -Y. Alireza - won the III Youth Olympic Games at the age of 15.5 while having a

body weight of 163.22 kg. In 2019, Y. Alireza took third place at the World Championship with a result of 396 kg. In total, his progress for the year was 66 kg. The athlete from Poland Szymon Kołecki set his world record at the age of 18.6 years, and although this result was never later achieved, he became the winner of the Olympic Games eight years later.

In the heavyweight categories, athletes from Western Asia have been dominating in recent years: Georgia, Armenia and Iran. Future champions and prize-winners of the Olympic Games participate in international competitions at the age of 15-16 years having already a significant body weight. Such athletes are ofteninjured and disqualified for doping before reaching adulthood. Also, fast progress is demonstrated by athletes from the Caucasus, who successfully compete in adult competitions. Among the YOG participants, 76% of the participants have the maximum age for these competitions, thus, a significant part of young weightlifters, whose age is not suitable for the YOG, remain without the opportunity to take part in the Youth Olympic Games, which does not exclude their chances to prove themselves in adult competitions.

The heavyweight competition at XXXI Olympic Games was reduced to the struggle of athletes from Georgia and Armenia, who took the first four places. Athletes debuted in international competitions at the cadet age (under 18) in the heavyweight (even by adult standards) category. For example, there are such athletes as the Olympic Games champion LashaTalakhadze(16.6 years, 124.3 kg) and a silver medalistGor Minasyan (15.6 years,116.76 kg). At the junior age, these athletes demonstrated competitive results compatible with adult competitions and their own weight was close to maximum indicators resulting in a two-year ban for doping. Silver medalist in the weight category of up to 105 kg Martirosyan Simon debuted at the European Championship at the age of 15.5 years with a body weight of 93.1 kg. These Armenian athletes have already received awards at the Youth Olympic Games. In 2017, Martirosyan became the best junior athlete of the World Championships according to the Sinclair coefficient, which allows comparing the results for different categories. In 2018-2019, he won the World championships in the category of up to 109 kg.

In total, among the winners of the XXXI Olympic Games, there are three YOGwinners.There is also a winner in the weight category of up to 77 kg (Nijat Rahimov, who has also already been punished for doping). Only 6.3% of the youth Olympic Games winners later became the Olympic Games winners. Such a low indicator corresponds to the same data in other sports (Platonov, 2013). Another young Armenian athlete - AndranikKarapetyan- also won a medal in the weight category of up to 77 kg and had a biography similar to his compatriots. His career was marked with participation in international competitions, intensive progress, weight gain and disqualification.HakobMkrtchyan, who won the YOG in the weight category of up to 77 kg, managed to rise from the 20th place at the World Championship among adults to the world champion in the category of up to 89 kg. IlyaIlyin, from Kazakhstan became the world champion among adultsat the age of 17.4 years. He regularly won the World championships in three different categories and set world records. However, as a result of a repeated doping test, he was deprived of the Olympic gold medals for the XXIX and XXX Olympic Games and was not admitted to the XXXI Olympic Games. The same was with three more winners of the Olympic Games from Kazakhstan (International Weightlifting Federation. Anti-Doping, 2019).

Russian weightlifters, winners of the cadet World Championships and YOG, as a rule, had a short career and achieved maximum results at their junior age. For example, KhetagKhugaev became the world champion among cadets in 2013 in the category of up to 77 kg.In 2014, he won the YOG in the category of up to 85 kg, a year later he demonstrated his best result in the international competitions in the category of up to 94 kg, and in 2019 he was at the seventh place at the World championships.

Ukrainian weightlifters, who won at the World championships among cadets, could not maintain their positions at a more mature age. There are also no examples of a long-term successful career among the YOG winners. Kostiantyn Reva, a bronze medalist of the YOG 2010,was the 13th at the 2019 World championships. Igor Obukhov won the 2015 Youth World championships and was named the best athlete which followed by his disqualification two years later.

Table 1 shows the analysis of individual progress of athletes.

Table 1.

The dynamics of progress for the winners of youth and adult competitions.

Weight categories, kg	Age at first competitions	Result, % of the best in career	Result, %(age<18years)	Result, %(age<21years)
56. 62. 69	16.2±0.3	87.3±4.2%	91.3±3.9%	96.2±2.7%
77. 85. 94	16.4±0.4	83.2±5.1%	89.4±4.7%	95.4±3.1%
105. +105	16.6±0.3	77.6±5.9%	86.5±5.3%	95.3±3.4%

Athletes in lightweight categories increase their own weight to the least extent. In middleweight and heavyweight categories, their personal weight increases by 20 kg or more, which allows to change 2-3 weight categories.

Most weightlifters from all over the world starttheir career at the age of 17-18 years andachieve the best results at the age of 24.4 ± 1.4 years.In a short period of time the athlete actually gains weight close to the upper limit of the weight category but then weight growth slows down.

Comparing the results of male weightlifters under 18 years old, under 21 years old and adult male weightlifters, who won prizes at 2018 World Championships and Olympic Games, it is possible to determine the proportions between the results of young and adult athletes: cadets/adults - snatch 85.1%, clean and jerk - 86%, combination - 8%, juniors / adults - snatch 87.5%, clean and jerk - 90.8%, combination - 89.2%. At the same time, the results of individual young athletes are at a significantly higher level. Thus, at the junior age it is even possible to achieve a record result for adults. World records for cadets / adults - snatch 90.6%, clean and jerk 91.6%, combination - 91.8%, juniors / adults - snatch 97.4%, clean and jerk - 96.5%, combination - 97.5%. The correlation coefficients of world records for cadets / adults- 0.96, for juniors / adults - 0.99. At the same time, some XXXI Olympic winners have correlations between the best result in adolescence and the best result in general(0.81), as well as between the best result in junior age and the best result in general (0.83).

This research confirms the data on the patterns of the dynamics of the competitive results of weightlifters. At the same time, significant differences in the dynamics of competitive results have been established depending on different countries and regions of the world, which has been little studied both in weightlifting and in other sports.

The modern training system provides for the systematic selection of young promising athletes, including in adult teams, where favorable conditions are created for performance enhancement. Such an athlete often rapidly reaches the limit of individual capabilities but continues to attend training camps, despite the gradual decline in the competitiveness of his results in the international arena. As a result, the training process becomes a kind of goal in itself, and not a part of the selection event for the adult team.

Conclusions:

1. In certain cases, modern training methods allow athletes to achieve maximum results from the age of 18 years. Maximum results in adolescence are typical for representatives of South-East Asia (lightweight categories) and Southwest Asia (heavyweight categories). At the same time, a significant part of weightlifters who have reached their maximum faster than the estimated model characteristics is severely injured and disqualified for doping.
2. For prize-winners at the XXXI Olympic Games, positive dynamics between weight growth and competitive results was established in the ratio of 1 kg of weight / 7.1 ± 0.6 kg in the combination of events. Weight growth with the transition to the next weight categories is a necessary condition for the steady progress of competitive results.
3. There is age limits expansionfor achieving maximum results and maintaining achievements. Individual weightlifters may show a gradual increase in their performance with maximum achievements over the age of 30 years.

Conflict of Interest Statement

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

References:

A. Barry Baker & Yong Q. Tang(2010)Aging Performance for Masters Records in Athletics, Swimming, Rowing, Cycling, Triathlon, and Weightlifting,Experimental Aging Research,36:4,453-477,DOI: 10.1080/0361073X.2010.507433.

Aksenov, M.O. & Ilyin, A.B. (2017). Training process design in weightlifting sports customized to genetic predispositions. TeoriyaiPraktikaFizicheskoyKultury, 6: 75-77.

Bulgakova, N. Zh. (2017). Analysis of sports biographies of champions and prize-winners of the 2016 Olympic Games in sports swimming. Bulletin of Sports Science, 3, 54-57.

Cherepov, E.A., Kalugina G.K., Khafizova A.S. (2019) Psychological and educatory service to facilitate sporting agenda formation in adolescents in sport training process. TeoriyaiPraktikaFizicheskoyKultury. 1. p.p. 97-99.

Cinar V., Talaghir LG., Abkulut T., Turgut M., SarıkayaM., 2017, *The effects of the zinc supplementation and weight trainings on the testosterone levels*, Journal Human.Sport.Medicine, 17(4):58-63

Dvorkin, L. S. (2001) Age dynamics of sports achievements of young weightlifters. Physical education: upbringing, education, training. 3: 28 – 31.

Elmenshawy, A. R., Machin, D. R., and Tanaka, H. (2015). A rise in peak performance age in female athletes. AGE 37:9795. doi: 10.1007/s11357-015-9795-8.

Galan, Y., Zoriy, Y., Briskin, Y. &Pityn, M. (2016). Orienteering to optimize the psychophysical wellbeing of young teens (13 to 14-year-old). Journal of Physical Education and Sport, 16(3), 914-920.

Huebner M and Perperoglou A (2019) Performance Development From Youth to Senior and Age of Peak Performance in Olympic Weightlifting. Front. Physiol. 10:1121. doi: 10.3389/fphys.2019.01121.

International Weightlifting Federation. Anti-Doping.https://www.iwf.net/anti-doping/sanctions/(accessed on 11.10.2019).

International Weightlifting Federation.Results by Events:https://www.iwf.net/new_bw/results_by_events/(accessed on 20.06.2019).

International Weightlifting Results Project. Weightlifting Database.http://iwrp.net/(accessed on 12.09.2019).

KhaledAbdel-RaoufEbada.Relativestrength, BodymassandheightasPredictorsofOlympicWeightliftingPlayersPerformance.Selçuk üniversitesibedeneğitimivesporbilimdergisi, 2011;13 (2):166–171.

Oleshko, V.G. (2005). Individual growth rates of achievements among highly skilled weightlifters at the final stages of sports performance enhancement. Pedagogy, psychology and biomedical issues of physical education and sport, 1: 28-37.

Platonov V. (2013) Forcing long-term training of athletes and the Youth Olympic Games. Science in Olympic sport. 2: 37–42.

Solberg, P. A., Hopkins, W. G., Paulsen, G., and Haugen, T. A. (2019). Peak age and performance progression in world-class weightlifting and powerlifting athletes. Int. J. Sports Physiol. Perform. 8, 1–24. doi: 10.1123/ijspp.2019-0093

Storey, A., and Smith, H. K. (2012). Unique aspects of competitive weightlifting: performance, training and physiology. Sports Med. 42, 769–790. doi: 10.2165/11633000-000000000-00000

Tovstonog O. (2017) Dynamics of individual indicators of sports results of weightlifters of the national team of Ukraine - participants of the XXXI Olympic Games.Sports Science of Ukraine. 1:77, 51 - 57.

Wright, Vonda & Middleton, Kellie. (2018). Masterful Care of the Aging Athlete: A Clinical Guide. DOI: 10.1007/978-3-319-16223-2.