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Bezkorovainyi D.

**PhD in Physical Education and Sports, Head of the Department of Physical Education and Sports
O. M. Beketov National University of Urban Economy in Kharkiv
Kamayev O.**

**Doctor of Sciences, Professor of the Department of Olympic Professional Sports
Kharkiv State Academy of Physical Culture
Zvyagintseva I.**

**Senior Lecturer of the Department of Physical Education and Sports
O. M. Beketov National University of Urban Economy in Kharkiv
Glyadya S.**

**Associate Professor of the Physical Education Department
National Technical University "Kharkov Polytechnic Institute"
Kravchuk Y.**

**Senior Lecturer of the Department of Physical Education and Sports
O. M. Beketov National University of Urban Economy in Kharkiv
Kulakov D.**

**Senior Lecturer of the Department of Physical Education and Sports
O. M. Beketov National University of Urban Economy in Kharkiv**

METHODOLOGICAL TECHNIQUES FOR INJURY PREVENTION DURING CLASSES AND COMPETITIONS IN ARMWRESTLING

The article identifies the causes of injuries and developed methodical techniques for their prevention in arm wrestling. During the study, the protocols of 92 ($n = 92$) arm wrestling competitions of various levels, from club to international, were analyzed, and 156 ($n = 156$) competitive movements of athletes were analyzed when performing arm wrestling techniques. In the course of the study, the protocols of 92 ($n = 92$) different level armwrestling competitions, from the club to the international competition were analyzed, 156 ($n = 156$) competitive movements were analyzed for athletes when armwrestling performing techniques. The data obtained indicate that, along with the increasing number of competitions, the number of injuries gradually and significantly decreases. So, at the first stage, during 24 competitions, athletes received 50 injuries, which on average annually amounted to 6.250 ± 0.701 cases; at the second stage, during 28 competitions, 15 injuries were received (1.875 ± 0.441 cases annually); at the third stage, out of 40 competitions, there were only 4 injuries (0.500 ± 0.267 cases annually). A clear and reliable dynamics in the reduction of injuries ($P < 0.01 - 0.001$) indicates that the development and spread of armwrestling has a positive impact on the professional development of coaches, referees and athletes. Significant dynamics of injury reduction indicates that preventive measures to prevent the causes of injury have a positive impact on the training of coaches, referees and athletes. The annual seminars with the involvement of qualified athletes made it possible to significantly improve the technique of performing competitive exercises, improve the means of preventing injuries, and increase the qualification level of judges. In addition, in recent years, the material and technical base for training athletes has been improved, the Rules for holding competitions have been adjusted, as well as the methodology for strength training of armwrestlers of various qualifications.

Keywords: armwrestling, jerking overloads, shoulder joint injury, screw fracture of the shoulder, recovery.

Безкоровайний Д. О., Камасєв О. І., Звягінцева І. М., Глядя С. О., Кравчук Є. В., Кулаков Д. В. Методичні прийоми профілактики травматизму під час занять і змагань з армрестлінгу. У статті визначено причини травматизму та розроблено методичні прийоми їхньої профілактики в армрестлінгу. Під час дослідження проаналізовано протоколи 92 ($n = 92$) змагань з армрестлінгу різного рівня, від клубних до міжнародних, проаналізовано 156 ($n = 156$) змагальних рухів спортсменів при виконанні прийомів армрестлінгу. Отримані дані свідчать про те, що поряд зі збільшенням кількості змагань кількість травм поступово і значно зменшується. Чітка та достовірна динаміка зниження травматизму ($P < 0,01 - 0,001$) свідчить про те, що розвиток і поширення армрестлінгу позитивно впливає на професійний розвиток тренерів, суддів та спортсменів. Достовірна динаміка зниження травматизму свідчить про те, що профілактичні заходи щодо попередження причин травматизму позитивно впливають на підготовку тренерів, суддів та спортсменів. Щорічні семінари із залученням кваліфікованих спортсменів дозволили значно вдосконалити техніку виконання змагальних вправ, удосконалити засоби профілактики травматизму, підвищити кваліфікаційний рівень суддів. Крім того, за останні роки покращено матеріально-технічну базу для підготовки спортсменів, скориговано Правила проведення змагань, а також методику силової підготовки армрестлерів різної кваліфікації.

Ключові слова: армрестлінг, ривкові перевантаження, травма плечового суглоба, звинтовий перелом плеча, відновлення.

Formulation of the problem. Sports of the highest achievements is a sphere of human activity, which is characterized by increased injuries, various kinds of occupational diseases, pre-pathological and pathological conditions that pose a threat to the health of athletes, the effectiveness of their training and competitive activities. Arm wrestling at the current level of its

development can be classified as a speed-strength sport in terms of the nature of the manifestation of muscle effort. It is a full and exciting sport with a well developed training and competition system. Let us immediately emphasize the special importance of the initial training system, even for athletes trained in other sports. The fact is that in armwrestling you can't immediately starting with direct fight. Since it is already known that without the proper readiness of the muscular, ligamentous-articular apparatus, both the upper shoulder and lower pelvic girdle for specific loads, it leads to serious injuries that may cast doubt on further armwrestling [6, 31].

Analysis of literary sources. The apparent simplicity of movements creates for many the illusion of the availability of this sport. At the same time, it should be emphasized that the heart rate during a competitive fight reaches 200–210 beats per minute, and the load on the elbow and shoulder joints, ligaments, bones of the forearm and shoulder is very high and reaches 150–200 kg. The hip joint and the muscular system of the lower extremities have a load of up to 250 kg [8, 10].

As the biomechanical analysis of the video recordings shows, in many cases, the injuries resulting from the struggle are caused by jerking overloads, and are often aggravated by an untimely visit to a specialist, and sometimes by continuing the loads through pain.

With injuries of jerk origin, the first and main area suffering from these injuries is the shoulder joint and the skeletal muscles that cover it. This happens due to high mobility (turning the shoulder inward, outward, straightening, moving the arms forward and backward, lifting) and minimal stability of this joint. Most successfully athletes performing in arm wrestling have genetic features that allow the shoulder joint to effectively perform work under increased loads on it, without injury or injury, but only slightly. This explains the absence of such injuries in athletes with professional status [12, 18, 20].

Not infrequently, during competitive loads, deeply lying layers of stabilizer muscles are injured. In this case, the forms of the deltoid change, dips form, or vice versa, there is an excessive accumulation of muscles in this area [23].

The resulting fractures of the bones of the shoulder joint (collarbone, vertebral part of the scapula, acromion, humeral head of the bone) are accompanied by the most emotional coloring, similar to pain during a fracture of the ribs, while the limb (arm) sags and loses the ability to move.

Often, with large and sharp power loads, the articular bag of the shoulder joint is disturbed. In this case, the minimum load (during abduction, adduction, pronation, supination of the limb) is accompanied by acute stabbing pain.

The next largest number of cases is injuries to the skeletal muscles of the limbs, in this case the hands. According to our data, the largest number of injuries in armwrestling is injuries of the joints (elbows – 70%, injuries of the wrist joint – 20%, and injuries and muscle tears – 10%) [3, 7, 21].

In an elbow and wrist injury, the symptoms are clear and cannot be confused with anything. The consequences are about the same as in the case of problems with the shoulder joint. It proceeds just as sluggishly, with the difference that the improvement comes much later. Unfortunately, it is practically impossible to restore the joints, since the joint is in constant motion and receives a load in one way or another, and there are literally few facts of restoration of damaged cartilage in the memory of medicine [22]. In such cases, it is necessary to focus on the fact that with ruptures of the muscle tissue of the hands, many of these ruptures are traumatic micro-ruptures of the muscles under the influence of an anatomically disadvantageous position, excessive tension and jerky load. They proceed almost imperceptibly, from a stagnant period develops into a chronic one, and then the chain leads to an appointment with a traumatologist.

An analysis of the literature data indicates that microtears are most common in the muscles: pronator teres, brachialis, flexor capri radialis, extensor capri radialis longus, anconeus, biceps brachii.

All these muscles cause stable work of the hands. The accumulation of micro-tears in these muscles leads to a weakening of their functions and a drop in athletic performance, which athletes often consider fatigue.

Based on the analysis, the main causes of injuries were established:

1. Unpreparedness of muscles, ligaments, joints or bones for jerking overloads;
2. Errors in the technique of performing the competitive movements of an athlete. The main mistake is when the athlete's arm remains in place during the start, and the body moves towards the roller, while the muscles are turned off and the rotational load is transferred to the humerus, resulting in a screw fracture (Fig. 1);
3. Unqualified refereeing, as a result of which wrestling in a traumatic position is allowed;
4. Medico-biologica and psychological causes of injuries (use of



stimulants).

Figure 1. Traumatic conduct of a duel in arm wrestling

Gaps in basic technique are found in almost all beginner athletes. The simplicity and accessibility of arm wrestling often play a cruel joke with beginners who think that there is nothing complicated in arm wrestling and try to fight without any study of technique.

Most often, a screw fracture of the shoulder is received by armwrestlers who competed with friends on a regular table. Thus, the main cause of injuries is the lack of technical skills of athletes. A common case when athletes who have previously been involved in any other power sport and have come to arm wrestling to try themselves get injured. Such athletes may have very high overall strength indicators, but at the same time they are not ready for the specific loads experienced by the hands of athletes during a fight at the table.

The first reason is the unpreparedness of the muscles, ligaments, joints and bones of an athlete for overload or jerks, usually closely related to the second cause of injuries – the lack of technical training. This is due to the lack of a special training load, typical for armwrestlers. Special exercises and work at the table help develop the muscles of the forearm, strengthen the tendons and ligaments of the elbow and shoulder joints. However, it also happens that a fairly experienced armwrestler who has the necessary technical skills, but at the same time, for various reasons, allowed a long break in training, gets injured. Many years of experience in training athletes suggests that it is necessary to go through at least six months of training with a frequency of at least 2-3 times a week before a beginner can be released to the first competition with great care. This is provided that this athlete is engaged under the supervision of a qualified coach, systematically performing special exercises, has mastered and improved the technique of wrestling at the table (Fig. 1). The same can be said about experienced athletes who, for various reasons, took a long break in training: it is necessary to restore their form before the competition, and not immediately start martial arts.



Figure 2. The correct position of the hands when installing the grip of armwrestlers

The third reason is unqualified refereeing. The topic is very complex and requires accuracy in assessments. An inexperienced referee does not always understand what it is to fight in a dangerous position. The following definition is given in the Armwrestling Rules: "Wrestling with a straightened arm in a critical position or a position in which the attacker's shoulder goes beyond the line of capture in the direction of attack can be classified as dangerous (Fig. 1). When a contestant is in a dangerous position, the referee must warn him without stopping the match. In case of repeated entry into a dangerous position by a participant, the fight is stopped and a warning is announced.

A dangerous position occurs when the athlete straightens the elbow of the struggling arm and lowers the shoulder below the plane of the table. Here it seems to the athlete that such a position protects him from defeat. In this case, there is also a lot of stress on the elbow and shoulder joints, which leads to serious injuries (Fig. 3).



Figure 3. Dangerous position in arm wrestling with lowering the shoulder below the plane of the table

Medico-biological and psychological causes of traumatism. Stimulants are of particular danger in terms of increasing sports injuries. Nervous system stimulants - derivatives of phenamine, leading to an improvement in sports results due to the elimination of protective inhibition, can lead to severe consequences for the health of athletes. So the use of phenamine derivatives has led to a number of deaths. Fatal cases among athletes as a result of cardiac disorders have been reported in arm wrestling competitions. Excessive use of anabolic steroids, unfortunately typical for arm wrestling, can lead to a change in the metabolism of connective tissue and a decrease in the strength of tendons and ligaments, and an increase in the risk of their ruptures [25, 27]. This is confirmed by a large number of spontaneous breaks in athletes during their competitive activities.

Structural and functional changes in the bone tissue caused by the excessive use of anabolics reduce their ability to endure the tension developed by the muscles; when these drugs are taken by young athletes, the process of growth of epiphyseal cartilages is disturbed in them [25].

Under the influence of the use of anabolic steroids, the mental state is disturbed, in particular, control over behavioral reactions is reduced, aggressiveness and excessive impulsivity are manifested. Their use increases the likelihood of cardiovascular diseases, liver function disorders up to the development of its insufficiency [26].

Diuretics, usually used to intensively reduce body weight or eliminate traces of the use of illegal drugs from the body, can cause serious side effects - electrolyte imbalance, a decrease in body resistance and an increase in the likelihood of injury, a negative effect on strength capabilities, endurance and coordination abilities [25].

All this indicates that arm wrestling is a very traumatic sport, therefore, injury prevention is extremely important, which allows to maintain the health of athletes and positively affect the image of the sport.

The purpose of the study is to determine the causes of injuries and develop methodological methods for their prevention during training and the occurrence of armwrestling.

Material and methods.

Participants. In the course of the study, the protocols of 92 (n = 92) different level armwrestling competitions, from the club to the international competition were analyzed, 156 (n = 156) competitive movements were analyzed for athletes when armwrestling performing techniques.

The analysis of competitive activity in arm wrestling was carried out for 3 stages: from 1997 to 2004, from 2005 to 2012 and from 2013 to 2020.

Methods. The following methods were used in the study: theoretical analysis and generalization of scientific and methodological information, analysis of competition protocols, training programs of various sports clubs in Ukraine; questioning, pedagogical observation, and analysis of the technique of competitive performing exercises, pedagogical experiment.

Statistical analysis of the obtained data was performed using the STATISTICA 10 licensed program. During the statistical analysis, the following parameters were calculated: arithmetic mean (\bar{x}), representativeness error (m), and Student's t-test.

Presenting main material. Given that arm wrestling in Ukraine is a relatively young sport, a comparative analysis of the number of complex injuries (mainly bone fractures) for 24 years, from 1997 to 2020, observation and registration of cases of injuries in referee reports made it possible to identify three stages of a gradual decrease in the number and the complexity of injuries received by armwrestlers at competitions of different levels. Every year, on average, 3-4 competitions were held in the Kharkiv region. In this case, the number and complexity of injuries received at competitions, ranging from the regional level to all-Ukrainian competitions, are taken into account. So, at the first stage (1997-2004) 24 competitions were held, at the second (2005-2012) – 28, at the third (2013-2020) – 40.

Analyzing sports activities in armwrestling, we can say with confidence that the development of the theoretical and methodological basis of this sport over the past decades has led to a significant reduction in the level of injuries during training sessions and armwrestling competitions.

An analysis of injuries received during armwrestling competitions is shown in Table 1.

Table 1 – Analysis of injuries received during armwrestling

Stage	Years	Number of competitions	The total number of injuries per stage	$\bar{x} \pm m$
I	1997-2004	24	50	6,250 ± 0,701
II	2005-2012	28	15	1,875 ± 0,441
III	2013-2020	40	4	0,500 ± 0,267

The analysis of injuries showed that athletes received injuries (screw fracture of the shoulder, tendon tears) during competitions up to 9 cases per year in the 1st period, up to 4 cases in the 2nd period and 1-2 cases in the 3rd period. And also there were years in the 3rd period in which no injuries were recorded (Fig. 4).

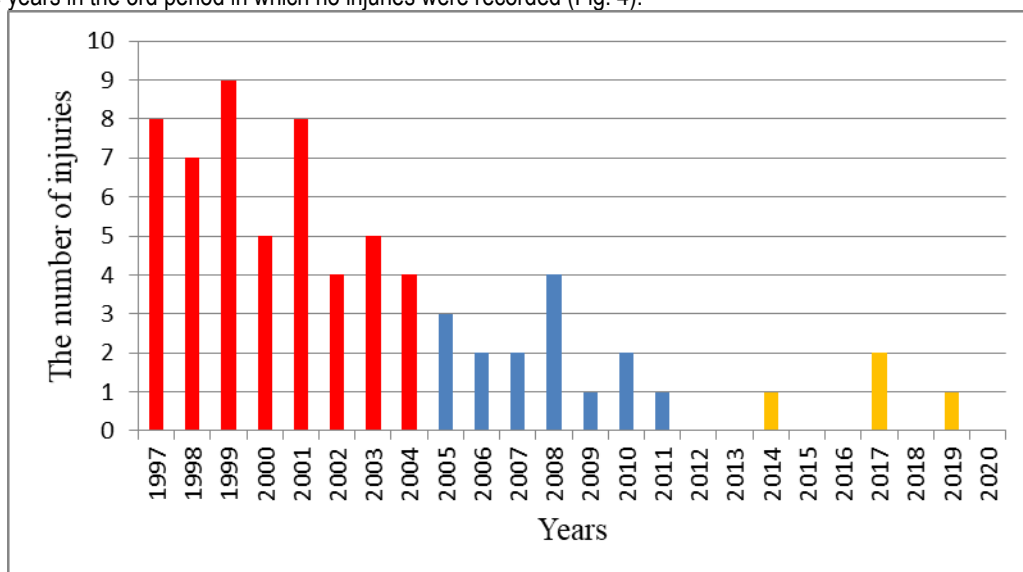


Figure 4. Dynamics of injuries in armwrestling

Such obtained data indicate that along with the increasing number of competitions from stage to stage, the number of injuries gradually and significantly decreases (Table 2). So, at the first stage, during 24 competitions, athletes received 50 injuries, which on average annually amounted to 6.250 ± 0.701 cases; at the second stage, during 28 competitions, 15 injuries were received (1.875 ± 0.441 cases annually); at the third stage, out of 40 competitions, there were only 4 injuries (0.500 ± 0.267 cases annually).

Table 2 – Reliability of changes in the number of injuries between stages

Stage	t-test	P
I-II	5,3	< 0,01
I-III	7,7	< 0,001
II-III	2,7	< 0,05

Such a clear and reliable dynamics of injury reduction indicates that the development and spread of arm wrestling has a positive impact on the professional development of coaches, referees and athletes. The annual seminars with the involvement of qualified athletes made it possible to significantly improve the technique of performing competitive exercises, improve the means of preventing injuries, and increase the qualification level of judges. In addition, in recent years, the material and technical base for training athletes has been improved, the Rules for holding competitions have been adjusted, as well as the methodology for strength training of armwrestlers of various qualifications.

The organization of the training process and competitive activity in arm wrestling requires taking into account various factors, the prevention of injuries of athletes is of particular importance. All this determines the success of the actions of athletes and sports longevity. Our data confirmed the opinion of other authors that there are several causes of injury in arm wrestling.

1. The unpreparedness of muscles, ligaments, joints or bones for jerky overloads and twisting loads on the humerus was noted by the authors [3, 7], and they state that the injuries received for this reason do not depend on the age and gender of the athletes.

2. Errors in the technique of performing competitive movements of an athlete are noted by the authors as the main cause of the most common injury in arm wrestling – a screw fracture of the humerus [23].

3. Unqualified refereeing, as a result of which wrestling in a traumatic position is allowed, is described from Komarevich et al., 2018 [14], and improving the qualifications of referees and the quality of refereeing is one of the methods for preventing injuries in arm wrestling.

4. Medico-biological and psychological causes of injury (the use of stimulant drugs) and the consequences of weight loss are confirmed by the works of Platonov, 2003; 2006 [25, 26].

The main direction of injury prevention is the technical and tactical training of athletes, as well as a well-constructed system of sports training. Prevention of injuries and diseases of athletes involves work to eliminate the risk factors that they are exposed to in terms of training and participation in competitions. The most typical mistakes in the training process of athletes that lead to injuries are the following:

– irrational alternation of loads, when the next lesson is carried out against the background of pronounced fatigue after the previous one;

– the use of excessively long loads, leading to deep fatigue;

– ultra-high intensity of work, which does not correspond to the level of adaptation of muscle, bone and fibrous tissues;

– insufficiently effective warm-up before a training or competitive load;

– insufficient attention to the establishment of effective non-traumatic sports equipment;

– lack of restorative means (massage, bath, special rubbing, etc.) between starts and individual training sessions with heavy loads;

– lack of control over the quality of sports facilities, places of employment, equipment, footwear, clothing, drinking regimen, nutrition, use of pharmacological agents.

Of great importance for the prevention of injuries is the rational construction of training programs, microcycles and mesocycles. Due to the optimal construction of these structural elements, it is possible to avoid a number of major risk factors for sports injury: excessive duration of monotonous training loads, irrational alternation of loads and rest, lack of a rational ratio of microcycles of hard work that stimulate adaptive reactions and recovery microcycles that create conditions for a full recovery and the flow of adaptive reactions.

Injury prevention is facilitated by a gradual increase in training loads after long breaks in training activities, especially if they were caused by injuries. The planning of maximum loads is permissible only with full confidence in the readiness of the functional systems of the body to transfer them.

Most injuries in sports are due to the presence of weak parts of the musculoskeletal system that are poorly prepared for competitive and training loads, an insufficient level of technical and tactical skills, that is, those risk factors that are directly related to the effectiveness of the athlete's training system.

Improving the rules of the competition, based on the safety requirements of athletes, is also an important reserve for reducing sports injuries. Many rule changes improve the safety of athletes and lead to a decrease in injuries in arm wrestling.

The effectiveness of the preventive work of athletes and coaches is directly dependent on the knowledge of risk factors that can lead to diseases and injuries. In the field of organization and methodology of training and competitions in modern elite sport, the following risk factors must be taken into account.

1. Logistics and organizational support of training and competitive activities:

– poor condition of sports facilities, training venues;

- low quality of sports equipment and training equipment;
 - irrational nutrition that does not correspond to the specifics of arm wrestling and the nature of the loads;
 - low quality of medical support for training and competitions.
2. Weather, climatic and geographical conditions of the places of training and competitions:
- high temperatures;
 - high humidity;
 - low temperatures;
 - air pollution;
 - abrupt change of time zones.
3. Preparedness and functionality of athletes:
- insufficient knowledge in the field of disease and injury prevention;
 - insufficient technical and tactical preparedness of an athlete;
 - insufficient elasticity of muscles, ligaments and tendons;
 - low level of coordination abilities;
 - disproportionate development of antagonist muscles;
 - the presence of hidden forms of diseases and untreated injuries.
4. Sports training system:
- inconsistency of training tasks with the level of preparedness of an athlete;
 - irrational sports equipment;
 - insufficient and ineffective warm-up;
 - performance of complex training tasks in conditions of obvious fatigue;
 - excessive physical and psychological stress;
 - irrational mode of work and rest;
 - irrational methods and means of training.
5. Nutrition, restoration and stimulation of working capacity and adaptive reactions:
- irrational nutrition that does not correspond to the specifics of the sport and the nature of the loads;
 - lack of vitamins and minerals;
 - irrational drinking regimen;
 - lack or irrational use of means of recovery.
6. Organization and holding of competitions:
- imperfection of competition rules;
 - low quality of refereeing, allowing for rough and risky tricks;
 - rough actions of the opponent;
 - insufficient and ineffective warm-up;
 - unnecessarily long breaks between individual starts and the lack of additional warm-up;
 - the use of insufficiently mastered techniques and actions.

Thus, one of the most important elements of injury prevention in armwrestling is the use of high-quality inventory and modern training equipment is an essential part of the overall strategy for the prevention of all types of sports injuries [27].

Improving the rules of the competition, based on the safety requirements of athletes, is also an important reserve for reducing sports injuries, the armwrestling federation is actively working in this direction, which leads to a reduction in injuries.

Conclusions. Analysis of scientific and methodological literature and many years of experience in preparing arm wrestlers for competitions showed that arm wrestling is a traumatic sport due to its speed-strength orientation. Injuries that occur in arm wrestling can be classified for the following reasons: 1) gaps in the athlete's technique; 2) unpreparedness of joints, muscles, ligaments or bones for overload or jerks; 3) unqualified refereeing, as a result of which wrestling in a traumatic position is allowed; 4) medical-biological and psychological causes of traumatism.

A clear and significant dynamics of injury reduction indicates that preventive measures to prevent the causes of injury have a positive impact on the training of coaches, referees and athletes ($P < 0.01-0.001$). The annual seminars with the involvement of qualified athletes made it possible to significantly improve the technique of performing competitive exercises, improve the means of preventing injuries, and increase the qualification level of judges. In addition, in recent years, the material and technical base for training athletes has been improved, the Rules for holding competitions have been adjusted, as well as the methodology for strength training of armwrestlers of various qualifications.

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