

Injury Prevention Program for Greco-Roman Wrestling

Georgiy Polevoy

ABSTRACT

Aim

is to develop a program for injury prevention using rehabilitation measures and targeted strengthening of the musculoskeletal system in Greco-Roman wrestlers.

Methods

The study involved 186 athletes of various qualifications who were engaged in Greco-Roman wrestling at a school of high sports mastery. Two groups of 26 people were formed, they took part in the pedagogical experiment during 12 academic months. All athletes trained according to the standard program for training wrestlers. In the experimental group, an additional experimental program for injury prevention was used, which included educational work with wrestlers, massage and self-massage, use of a sauna, proper warm-up, special muscle training, strengthening of the musculoskeletal system, fatigue prevention, and keeping a diary of athlete self-monitoring.

Results

The comparative analysis of the indicators for the period of the pedagogical experiment showed that in the experimental group the number of minor injuries decreased from 85 to 66 (22.4%), the number of moderate injuries decreases from 173 to 156 (9.8%), and the number of severe injuries decreased from 45 to 38 (15.6%). In the control group, the number of minor injuries decreased from 78 to 73, the number of moderate injuries decreased from 159 to 151 (5%), and the number of severe injuries increased from 60 to 62 (3.2%). At the end of the pedagogical experiment, the injury rate in the experimental group decreased by a total of 14.2% ($P < 0.05$), and in the control group by 3.7% ($P > 0.05$).

Conclusion

Based on the results of the pedagogical experiment, it can be concluded that, to a certain extent, sports injuries are a manageable process. And if organization of preventive measures is appropriate, sports injuries can be reduced to minimum, especially the number of moderate and severe injuries. Thus, the injury prevention program for Greco-Roman wrestling has proven its effectiveness in the course of the practical pedagogical experiment and can be used in children's and professional wrestling schools.

Keywords

Injury; Joints; Muscles; Ligamentous Apparatus; Training Sessions.

INTRODUCTION

Wrestling is one of the most ancient sports. Its origin goes back in ancient times. Along with work skills, wrestling techniques were also accumulated and passed from generation to generation. In wrestling matches, strength, agility, courage, and cunning can be shown. Monuments of art speak of the popularity of wrestling in the past. In Ancient Sparta, there was a whole system of physical education for young people, in which wrestling occupied a prominent place. And in Ancient Greece, wrestling was the second sport after running included in the program of the Olympic Games of antiquity. Modern wrestling is called Greco-Roman, and the first world championship was held in 1904 in Vienna^{1,2}.

Wrestling places very high demands on the athlete's body. During the fight, wrestlers use various technical and tactical actions associated with the manifestation of significant muscle tension, speed, agility and endurance. Short-term muscle tension alternates with holding the breath and excessive tension. During competitions, a wrestler has to fight several times over two or three days and maintain a certain weight. All this requires the wrestler to comply with certain hygienic requirements^{3,4}.

A rational daily routine allows creating optimal conditions for studying and playing sports, and will help maintain high performance of wrestlers.

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An athlete's daily routine depends on many factors - age, class schedule at the university and sports section, length of time in wrestling and level of physical fitness, seasonal and climatic features of the region in which the athlete lives, as well as individual characteristics of the body. The main principles of a rational routine are morning exercises and water-hardening exercises, quality sleep for 8 hours, diet (the right combination of proteins, fats and carbohydrates during the day), drinking regime (more than 40 ml of water per 1 kg of weight)^{5,6}.

Professional wrestling requires strict adherence to daily regime. Systematic violations of a rational regime are usually associated with so-called bad habits, such as smoking, overeating, excessive consumption of coffee or alcohol. The emergence of bad habits negatively affects the entire system of training a wrestler^{7,8}.

A thorough examination by a sports doctor is extremely necessary, since heavy loads can significantly activate the development of any hidden pathology. Restrictions for wrestling are diseases of the cardiovascular and respiratory systems^{9,10}.

In wrestling practice, injuries such as abrasions, wounds, bruises, sprains (microtraumas) and ruptures of the ligamentous joint apparatus, fascia, tendons and muscles, subluxations and dislocations of joints, fractures of cartilage and bones, concussion, spinal cord injury, paralysis, injuries to nerve endings, fainting and others are possible.

Among injuries of the upper extremities, the most typical are ruptures of the clavicle-acromial joint (when irrational throws with a bend happen). A dislocation in the shoulder joint also occurs when falling on an arm extended or abducted in the direction of a throw. Falling from above on a shoulder pressed to the body causes a fracture of the clavicle^{11,12}.

A rotational dislocation in the shoulder joint occurs with a sharp backward throw of the shoulder and forearm, when the anterior internal part of the capsule of the shoulder joint is stretched. An elbow injury occurs when falling on an outstretched arm^{13,14}.

The most vulnerable part of the wrestlers' locomotor system is the knee joint. The internal meniscus is most often damaged. A severe type of injury is a rupture of the ligamentous apparatus of the knee joint^{15,16}.

Chest injuries (bruises, fractures and cracks of the ribs), fractures of the forearm and wrist bones, subcutaneous hemorrhages in the auricle¹⁷.

The causes and factors of injuries in wrestling are very diverse. External and internal factors of sports injuries can be distinguished¹⁸.

External factors of injuries include: omissions in the methodology of organizing classes, deficiencies in the material and technical support and condition of the training areas (poor carpet maintenance, lack of side mats, close location of other equipment, equipment malfunction, equipment that does not correspond to the height, weight and training of the trainees), unfavorable hygienic and meteorological factors (incorrectly selected clothing and footwear, lack of special uniforms, especially bandages and footwear), failure to comply with medical supervision requirements, incorrect actions and insufficient technical training of athletes, failure to comply with doctor's recommendations^{19,20}.

Athletes often get injured due to failure to comply with hygiene standards and rules for conducting classes: insufficient lighting; high air temperature and humidity; conducting classes immediately after work (study, work), meals and sleep; very frequent classes; simultaneous classes of several groups and a large number of trainees; combining different groups of trainees (by age, training) into one group; failure to comply with didactic principles of training and patterns of sports training; forced preparation; premature participation in competitions (without sufficient preparation); insufficient warm-up; insufficient supervision of the trainer-teacher.

Internal factors of injuries include: insufficient preparation of the athlete; state of fatigue; training in a painful state; deterioration of the functional state of individual body systems; disorder of the normal function of internal organs (overfatigue, overtraining, smoking, alcohol); improper weight loss^{13,15}.

In the state of fatigue and overfatigue caused by irrational training loads, attention, the speed and accuracy of movements decrease, the process of muscle contraction and relaxation is disrupted^{17,21}.

Prevention of sports injuries consists primarily in eliminating the factors that lead to injuries.

The analysis of injuries in the strongest wrestlers shows that they are most often a consequence of overloads of individual parts of the musculoskeletal system. They have different origins^{13,17}:

- 1) Total increase in load (volume and intensity);
- 2) loads increasing due to changes in habitual

biomechanics (carpet surface, new equipment, health condition);

3) local overloads resulting from the concentration of efforts in weak parts of the musculoskeletal system, which are formed due to unstable special skills and poor development of individual muscle groups.

The first two types of overloads are determined without difficulty. Difficulties arise when determining the third group of overloads. In order to reveal the nature of the emergence of disproportions in the formation of special motor skills and the development of individual muscle groups and parts of the musculoskeletal system, it is necessary to consider modern trends in the development of wrestling^{22,23}.

Over the past 10-15 years, wrestling has undergone significant changes. First of all, it is a new configuration and quality of mats, a reduction in the period of the fight and the abolition of wrestling on the ground, the activation of technical actions, and a completely new idea of the ways and methods of mastering the technique and tactics of wrestling. However, in practice, the attitude to the training process has become somewhat one-sided: preference is mainly given to the formation of attacking actions in the wrestler, while mastering defensive techniques has become underestimated. In particular, the requirements for special exercises on the bridge and the practice of using the bridge in the process of mastering complex technical and tactical actions have been reduced. All this leads to insufficient special training of the wrestler, which is one of the prerequisites for the occurrence of traumatic situations^{15,19}.

As for injury prevention, there are some general recommendations, such as^{12,18}:

- 1) constant monitoring of the condition of training areas (serviceability of equipment, ventilation, cleanliness, maintaining lighting standards);
- 2) compulsory use of independent insurance, insurance and assistance when performing various exercises and technical actions;
- 3) thorough warm-up;
- 4) mastering safety precautions;
- 5) careful planning of classes (sequence of training tasks, selection of pairs, determination of the amount of training loads depending on the individual characteristics of athletes);
- 6) constant pedagogical monitoring of the health and

level of training of athletes;

- 7) reduction of the amount of training load in case of fatigue, the first signs of which are pallor, overexcitement, impaired coordination, deterioration of attention, apathy, drowsiness;
- 8) compulsory regular medical examination of those involved;
- 9) adherence to a strict routine and rules of a healthy lifestyle;
- 10) compliance with all pedagogical principles of organizing and constructing training sessions (accessibility, gradualness, durability, clarity, activity);
- 11) implementation of an individual approach to those involved;
- 12) optimal combination of load and rest;
- 13) constant educational work with athletes (strict discipline in classes, friendly mutual assistance, demanding attitude towards oneself and partners, maximum composure in classes, absence of prohibited techniques, fostering respect for one's opponent, fostering a creative attitude towards training).

Special attention should be paid to the prevention of spinal injuries. To strengthen the cervical spine, special exercise complexes are used, close in structure to the elements of wrestling on the ground, the bridge position is practiced in both attacking and defensive actions. This allows the wrestler's body to be consistently brought to mastering various groups of standing techniques, expands the practical possibilities of using the bridge, gradually complicating the conditions of its use^{15,21}.

Thus, the literature covers the problems of combating various types of injuries quite widely. However, the issue of injury prevention in Greco-Roman wrestling has not been sufficiently studied.

The hypothesis of the study is the assumption that if a program for injury prevention using rehabilitation measures and targeted strengthening of the musculoskeletal system is developed, this will help reduce the percentage of injuries sustained by Greco-Roman wrestlers, speed up the process of restoring performance after injuries, and in general, help maintain and strengthen the health of athletes involved in wrestling.

The aim of the study: to develop a program for injury prevention using rehabilitation measures and targeted strengthening of the musculoskeletal system in Greco-Roman wrestlers.

Research objectives:

1. To analyze literary sources and identify the main injuries and causes of injuries in Greco-Roman wrestling.
2. To develop the content of an injury prevention program for Greco-Roman wrestling.
3. To determine the effectiveness of the developed injury prevention program.

MATERIALS AND METHODS

Before starting the study, we analyzed the frequency of injuries among 186 athletes of various qualifications at the Kirov School of Higher Sports Mastery (figure 1). The average number of injuries per athlete depending on the training group was taken into account.

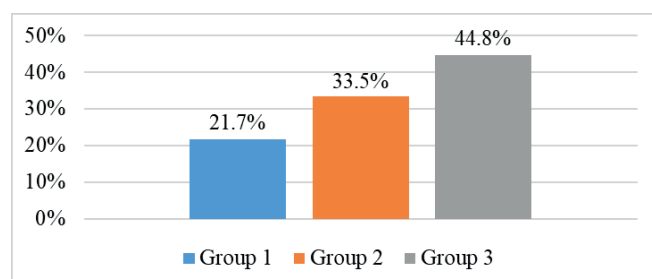


Figure 1. Frequency of injuries among athletes of various qualifications.

Figure 1 shows that the frequency of injuries among qualified athletes (Group 3) is higher than among athletes in training groups (Group 2) and among athletes in the initial training group (Group 1). To a certain extent, this is due to higher physical loads in the training of highly qualified athletes. This is also explained by an insufficiently responsible attitude to the treatment of injuries, the resumption of training before functional recovery, as well as insufficiently developed diagnostics and assessment of the functional state of the neuromuscular system, and the fact that issues regarding effective means of restoring the neuromuscular system after great physical strain have not yet been fully studied. The most common injuries were the following:

- 1) elbow and shoulder joint injuries – shoulder and forearm dislocation, clavicle fractures (18%);

- 2) ruptures of the acromioclavicular joints and muscles of the upper extremity in the forearm area (15%);
- 3) damage to the fiber bundles of the muscles of the back and neck, chest contusions, rib fractures (18%);
- 4) ear injuries (27%);
- 5) damage to the bursal ligament apparatus, knee and ankle joints and muscles of the lower limbs (22%).

The periods of the training process of athletes were also analyzed, in which they received the greatest number of injuries, regardless of their sports qualifications (figure 2).

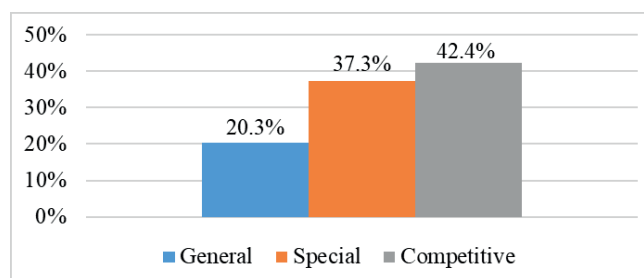


Figure 2. The number of injuries among wrestlers depending on the period of training.

It should be noted that during the training period at the general preparatory stage, athletes receive most injuries as a result of violating the rules for maintaining training facilities and prematurely starting training after an illness or injury.

At the special preparatory stage, the number of injuries depends on the incorrect selection of sparring partners and training against the background of insufficient recovery.

The number of injuries received during the period of competitive activity is affected by the indicators of the level of technical and tactical training and the development of physical qualities.

The reasons that determine the number of injuries were then identified (figure 3).

- 1) technical and tactical preparedness;
- 2) level of development of physical qualities;
- 3) training against the background of insufficient recovery;
- 4) incorrect selection of sparring partners;
- 5) premature start of training after illness, injury;
- 6) violation of rules for maintaining training facilities.

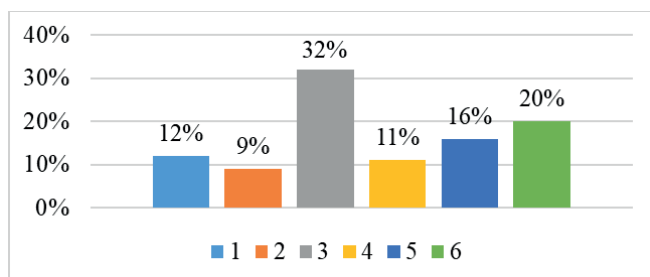


Figure 3. Factors influencing wrestler injuries.

Taking into account all considered, the injury prevention program was developed and tested in the experimental group from January 1 to December 31, 2024, in the same sports school. Before the start of the pedagogical experiment, two groups of athletes were formed, 26 people each. Both groups of athletes trained according to the standard training program for Greco-Roman wrestlers. The injury prevention program was additionally developed for athletes from the experimental group, which included 8 obligatory things:

- 1) educational work with Greco-Roman wrestlers;
- 2) sports massage and self-massage;
- 3) use of a steam bath and sauna;
- 4) training to warm-up properly;
- 5) special muscle training;
- 6) strengthening the musculoskeletal system;
- 7) prevention of fatigue;
- 8) keeping an athlete's self-monitoring diary.

1. Educational work. Particular attention was paid to educational work with wrestlers, causes of injuries and measures to prevent them were explained to them. All athletes were demanded to be disciplined, extremely attentive and take good care of sparring partners and personal protective equipment (Table 1).
2. Sports massage and self-massage. During the study, athletes learned simple techniques and methods of sports massage, which they used in the final part of training sessions, as well as during the recovery period after training^{24,25}.

Methodical instructions for self-massage:

- 1) self-massage is performed in the morning after sleep or morning exercises, as well as 1-2 hours before sleep;

Table 1. Theoretical training program on injury prevention for wrestlers

№	Topic Title	Number of hours
1	Discipline and rules of conduct in wrestling classes.	2
2	Safety precautions and injury prevention when training.	4
3	The impact of sports on the structure and functions of the human body.	2
4	Hygiene, hardening, nutrition and daily routine of a wrestler.	6
5	Equipment and inventory for Greco-Roman wrestling.	2
6	Medical supervision and self-control.	2
7	Sports massage and self-massage.	4
8	Keeping a self-control diary.	2
TOTAL:		24

- 2) massage can be performed through light clothing;
- 3) the number of techniques used, their intensity during the procedure are changed to avoid addiction;
- 4) the first massage procedures should be light and short in time;
- 5) after the massage, it is necessary to rest for 20-30 minutes;
- 6) the tolerance of the massage should be noted in the self-monitoring diary.
3. Use of a steam bath and sauna. During the pedagogical experiment, there were 2-3 goes to the sauna for 5-10 minutes. The number of goes was increased if the following day was free from training. When using a steam bath to restore performance after training, it is necessary not to overexert yourself, and therefore goes to the steam room were short, and the rest lasted longer. A cool shower was used between goes to the steam room, which contributed to the rapid restoration of the cardiovascular system. During the rest between goes to the steam room, the athletes took fruit juices, tea, mineral water. This contributed to the restoration and faster restoration of the water-salt balance, increased sweating in the next go to the steam room. As auxiliary means, the athletes used a contrast shower and a pool. Thanks to all this complex therapy, according to subjective data, the athletes felt very well rested and cheerful²⁶.

4. Training to warm-up properly. A well-done and correct warm-up significantly reduces the risk of injury and increases physical fitness. In addition, it creates the necessary psychological mood before the upcoming loads^{27,28}. The warm-up necessarily included soft and slow stretching of muscles and joints. At the same time, strong loads on the joints in their extreme positions were not allowed. The warm-up time was 15-20 minutes.
5. Special muscle training. The athlete and the coach must know which muscle groups are most important for the sport, which ones bear the greatest load, which ones are often subject to injuries. All these muscle groups should be trained specifically for injury prevention²⁹⁻³¹. During the pedagogical experiment, the main attention was paid to the development of the hip flexor and extensor muscles, abdominal muscles, as well as joints (knee, ankle, shoulder, elbow, wrist and fingers).
6. Strengthening the musculoskeletal system included exercises to stretch muscles and ligaments, and develop the muscular corset. The main focus was on developing flexibility, coordination, and strength abilities. Weaknesses in the technical and tactical preparedness of wrestlers were identified, and work was carried out to eliminate them.
7. Fatigue prevention included a rational daily routine, medical and pedagogical control, and self-control (keeping a self-control diary).
8. Keeping a self-control diary of the athlete, in which the main points are noted (the content of the training session, the volume and intensity of the load, training methods, and well-being). The results for the week of training are summarized (the number of days and hours, means and their volume, load, and recovery measures).

During the pedagogical experiment, obligatory preventive measures were carried out in the educational and training process of Greco-Roman wrestlers:

- 1) weekly educational work with wrestlers was carried out;
- 2) the self-monitoring diary was checked daily;
- 3) visiting the sauna and steam bath twice a week: 3 goes for 5-10 minutes;
- 4) daily massage or self-massage for 5-7 minutes was carried out;

- 5) 2 times a week, exercises for special muscle training were included in training sessions.

The following methods of mathematical statistics were used when processing the research results:

- 1) arithmetic mean \bar{x} ;
- 2) to assess the growth rates of the indicators, the formula by V.I. Usakov was used:

$$W = \frac{100(V_2 - V_1)}{0,5(V_2 + V_1)};$$

where W – assessment of growth rates of indicators (%), V_1 – initial level, V_2 – final level.

The data of the research results do not obey the law of normal distribution, therefore, they are nonparametric. Out of all nonparametric criteria of mathematical statistics, the Van der Waerden t-criterion was chosen. All calculations were performed in the Microsoft Excel program.

RESULTS

At the beginning of the educational experiment, the analysis of medical records for the previous year showed that the Greco-Roman wrestlers in the experimental group had an average of 13.2 injuries per athlete. A total of 303 cases were recorded. Overall, 28.0% (85 cases) were minor injuries, 57.1% (173 cases) were moderate, and 14.9% (45 cases) were severe.

In the control group, there were an average of 12.9 injuries per person a year. The total number of injuries was 297, out of them, 26.3% (78 cases) were minor injuries, 53.5% (159 cases) were moderate, and 20.2% (60 cases) were severe.

After the end of the educational experiment, the injury rates in both groups changed (table 2).

Table 2. Number of injuries during the period of the pedagogical experiment

Injuries	Control group		Experimental group	
	Before	After	Before	After
Minor	78	73	85	66
Moderate	159	151	173	156
Severe	60	62	45	38

Table 2 shows that during the period of the pedagogical experiment, the number of injuries in the experimental group decreased significantly. In the control group, the number of minor and moderate injuries decreased only slightly, while the number of severe injuries increased. In percentage terms, the indicators look as follows (figure 4).

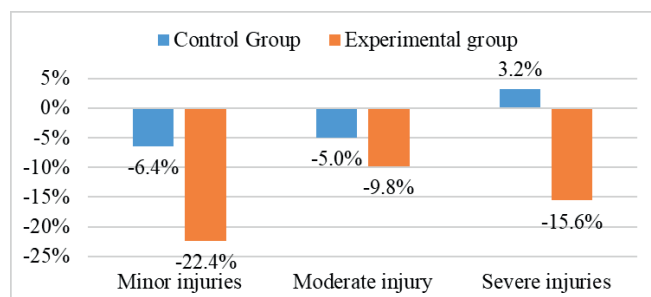


Figure 4. The ratio of injuries of wrestlers in both groups during the period of the pedagogical experiment

Figure 4 shows that the athletes in the experimental group had a decrease in minor injuries by 22.4%, a decrease in moderate injuries by 9.8%, and a decrease in severe injuries by 15.6%. In the control group, minor injuries decreased by 6.4%, moderate injuries by 5%, and severe injuries increased by 3.2%.

At the end of the educational experiment, injuries in the experimental group decreased by 14.2% ($P < 0.05$). A total of 260 cases were recorded. In the control group, 286 cases of injuries were recorded by the end of the educational experiment, and injuries decreased by an average of 3.7% ($P > 0.05$).

DISCUSSION

Greco-Roman wrestling places very high demands on the athlete's body. During the fight, wrestlers use various technical and tactical actions associated with the manifestation of significant muscle tension, speed, agility and endurance. Short-term muscle tension alternates with holding the breath and overload. During competitions, the wrestler has to fight several matches, maintain a certain weight. All this requires a lot of strength from the wrestler and can often lead to an injury. As a rule, these injuries are not life-threatening. However, they affect the general and athletic performance of the athlete, putting the athlete out of action for a long period and often requiring a lot of time to restore lost performance^{3,9,22}.

In modern wrestling, the problem of injury prevention and recovery is as important as the training itself, since it is impossible to achieve high results only by increasing the volume and intensity of loads. The complex of preventive measures includes a wide variety of means: massage, pharmacological agents, appropriate sanitary and hygienic conditions in the training areas, etc. A skillful combination of all means of injury prevention at various stages of the training process is the key to its effectiveness and makes it possible to avoid adverse effects of training loads^{13,17}.

The analysis of literary sources has shown that in wrestling practice such injuries as abrasions, wounds, bruises, sprains and ruptures of the ligamentous articular apparatus of fascia, tendons and muscles, subluxations and dislocations of joints, fractures of cartilage and bones, concussion, spinal cord injury, paralysis, fainting and less dangerous injuries are possible. The following external and internal causes of injuries in Greco-Roman wrestling have been identified^{11,16}.

External causes of injuries to wrestlers include: omissions in the methodology of organizing classes, deficiencies in the material and technical support and condition of training venues, unfavorable hygienic and meteorological factors, failure to comply with medical supervision requirements, incorrect actions and insufficient technical training of athletes, failure to comply with doctor's recommendations^{12,18}.

Internal causes of injuries to wrestlers include: insufficient training of an athlete; state of fatigue; training in a painful condition; deterioration of the functional state of individual body systems; disorder of the normal function of internal organs; incorrect weight loss¹⁹⁻²¹.

The following is the specific features of the injury prevention program in Greco-Roman wrestling classes: weekly educational work with wrestlers; daily checking of the self-monitoring diary; goes to the sauna and steam bath were provided twice a week: 3 goes for 5-10 minutes; massage or self-massage was performed daily for 5-7 minutes; exercises for special muscle training were included in training sessions twice a week; at the beginning and end of the weekly training, athletes underwent pedagogical and medical control.

The results of the study showed the effectiveness of the injury prevention program for Greco-Roman wrestlers. The number of all injuries in the experimental group

decreased significantly. For example, the number of minor injuries decreased by 22.4%, the number of moderate injuries decreased by 9.8%, and the number of severe injuries decreased by 15.6%. Despite the fact that only 260 cases of injuries were recorded per year, their level decreased by 14.2% ($P < 0.05$). The data certainly speak to the effectiveness of the experimental methodology when working with Greco-Roman wrestlers in the experimental group.

As for the Greco-Roman wrestlers from the control group, their overall injury rate decreased, but not significantly, by only 3.7% ($P > 0.05$), with a total of 286 injuries. In the control group, the number of minor injuries decreased by 6.4%, the number of moderate injuries decreased by 5%, and the number of severe injuries increased by 3.2%. This indicates the low effectiveness of the standard training program for wrestlers in the injury prevention section.

The scientific novelty of the study is that for the first time the study was conducted specifically on Greco-Roman wrestlers and specific recommendations were given for injury prevention in wrestling.

To prevent injuries in Greco-Roman wrestling, it is necessary to fulfill a number of requirements:

- 1) strictly adhere to a properly composed daily routine;
- 2) undergo a medical examination twice a year;
- 3) carefully plan classes (sequence of training tasks, selection of partners and opponents, determination of the amount of training loads depending on the individual characteristics of those involved);
- 4) carry out constant pedagogical control over the health and level of training of those involved;
- 5) strengthen the musculoskeletal system, develop basic motor skills and improve the technical and tactical training of wrestlers;
- 6) athletes must keep a self-monitoring diary, and coaches must regularly check it;
- 7) special attention should be paid to educational work with wrestlers, explaining to them the causes of injuries and measures to prevent them;
- 8) to prevent sports injuries, it is recommended to

use hydrotherapy procedures and sports massage techniques.

The practical significance of the study is that its results can be used in the practical work of coaches in Greco-Roman and other styles of wrestling, as well as for all wrestlers of various specializations. The practical significance of the results obtained is also due to the possibilities of their use to improve the process of athletes' recovery, which should contribute to an increase in their physical fitness and thereby further increase the effectiveness of injury prevention for wrestlers.

CONCLUSION

Based on the results of the pedagogical experiment, it can be concluded that, to a certain extent, sports injuries are a manageable process. If the organization of preventive measures is appropriate, sports injuries can be reduced to a minimum, especially the number of moderate and severe injuries.

The developed and used experimental program gives a positive effect, reliably reducing the number of injuries in Greco-Roman wrestling. The results of the scientific study can be used in children's sports schools and in professional sports for wrestlers of different styles.

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Ethical Approval: Ethical approval was taken from Ethics Committee of Moscow Aviation Institute, Moscow, Russia.

Conflict of interest: The author declares that he no conflict of interest.

AUTHOR'S CONTRIBUTION

Data gathering and idea owner of this study: Polevoy G.G.

Study design: Polevoy G.G.

Data gathering: Polevoy G.G.

Writing and submitting manuscript: Polevoy G.G.

Editing and approval of final draft: Polevoy G.G.

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