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Optimising the Competitive Performance of Junior Greco-Roman Wrestlers by Consolidating and Improving Their Takedown Techniques

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Abstract: *In elite wrestling, achieving the best results in major competitions is the primary goal of all activities, and the secondary goal is to provide a recreational, compensatory, or therapeutic approach. In this regard, one of the current concerns in establishing the competition system focuses on children's competitions. For this reason, specialists in this field are turning their attention to getting as many children as possible involved in sports competitions. They will later represent the base of the secondary selection that will deliver juniors aspiring to important titles. This paper aims to improve the takedown technique's performance in the training process through effective means developed after video analysis of the elemental mechanisms that constitute the action studied. The research was carried out between 19 February and 9 September 2022 within the Greco-Roman Wrestling Section of the School Sports Club no. 5 in Bucharest. The participants were advanced junior athletes aged between 15 and 17 years, competing in the Individual National Greco-Roman Championships. For the study scope, they were divided into two groups (a control group of 9 athletes and an experimental group of 9 athletes). Although both groups obtained similar results in the initial test, the experimental group achieved clearly better results in the final test compared to the control group, which demonstrates the difference between the types of training performed by the two groups.*

Keywords: *elite sport, Greco-Roman wrestling, takedown techniques.*

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Introduction

Competition is the central element of sports performance, and all the other activities are organised around it, but without minimising the interaction between these factors and the feedback established in the training cycles.

For athletes, competition is an opportunity to demonstrate their performance capacity and confirm their predicted potential (Dragnea & Teodorescu, 2002). Introducing athletes to the competitive circuit also contributes to supporting their motivation to practise elite sport.

It should be mentioned that, in elite sport, there is an indissoluble relationship between training, competition and performance (Figure 1).

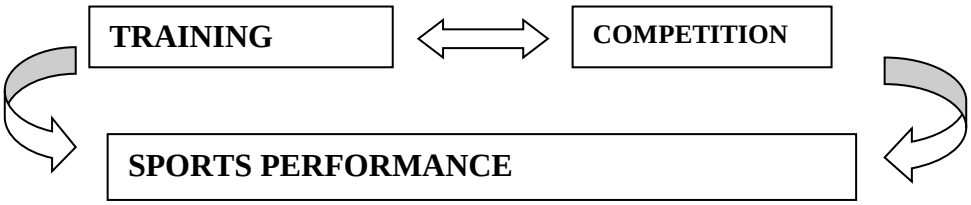


Figure 1. Relationship between training, competition and performance in elite sport

Starting from the requirements imposed by participation in competitions, a training model will be designed and implemented in the training process for the development of performance capacity within a certain timeframe. The major competition in which the athlete aims to achieve successful performance becomes the most important benchmark in programming and planning the entire training process (Sabitjonovich, 2022).

Since athletes use their entire body in combat, not all athletic competitions have an achievement goal and no athlete will enter all the listed competitions. in the schedule (Gierczuk et al., 2017; Cieśliński et al., 2021). The number of major and friendly competitions in which wrestlers will participate should be constantly related to their age characteristics and individual traits, training stages, available time and training conditions.

Competitive results will be properly analysed and interpreted in order to guide methodological strategies for future training. Competition thus becomes the most reliable test in sports training (Hurramovich et al., 2020). Increasing training efficiency is not possible without regularly assessing the effects of training through competition.

According to Tudor (2013), competition can be considered a form of summative assessment but, as a whole, it is both a continuous assessment and an initial assessment for the future training period, aiming at:

- knowing the athlete's body reaction to training and the characteristics of fatigue and recovery processes;
- determining the level of functional abilities of different systems, organs or mechanisms with a decisive role in making competitive activity more efficient;
- checking the exercise parameters;
- estimating the athlete's ability to adapt to exercise;
- testing the development level of motor skills as well as technical-tactical and psychological preparedness;
- scientifically identifying the periods and methods of entry into sports form;
- knowing the athlete's psychological capability;
- comparing the results obtained in competitions with previously established objectives;
- establishing the level of technical and tactical qualification;;
- determining the efficiency of competitive activities;
- using the results of the assessment process in the scientific activity of sports training.

The rules of Greco-Roman wrestling competitions have undergone many changes, especially in the last 20 years. Changes to the regulations were generally aimed at increasing the dynamism and spectacularity of the fight, integrating into the concept of total, universal, risky, creative, spectacular and virtuous combat (Yuldashevich et al., 2020). The new rules derive in a significant increase in technical wins over points conquered (Tünnemann, 2013). Takedowns are commonly based on simple technical mechanisms that make them easier to learn, especially those that do not require cadet and junior athletes to lift and balance-off their opponents, immediately after acquiring combat-specific motor skills (Tropin, 2013). However, these techniques cannot be considered easy because their execution is based on the superior development of general and segmental strength (arms, shoulder girdle, back) (Demirkan et al., 2014; Dehnou et al., 2020).

Changes to the competition regulations have an impact on the way of fighting, with many actions performed in a standing position. Therefore, it is imperative for athletes to learn and improve their takedown techniques,

which are rated from 1 to 5 points, thus contributing to the dynamism and spectacularity of the fight.

The learning and improvement of takedown techniques during workouts through training plans and means should be also done by carefully studying the biomechanical characteristics of the movements that compose the technical actions (Anarbayev et al., 2022).

Research hypothesis. Takedown techniques can be improved using video equipment as a means of training, in the sense of understanding the technical and biomechanical analysis of the actions performed. Also, takedown techniques will be used to a greater extent in competitions following their improvement through several means of training.

The *purpose* of this paper is to contribute to improving the performance of takedown techniques during the training process through effective means designed after analysing the basic mechanism that composes the studied action. The technical analysis was carried out based on the video recording of the takedown techniques used.

Research question: Will the identification of takedown-related technical mistakes through video analysis lead to their correction and greater use in sports competitions?

Methodology

Research methods

The theoretical background of improving the technical training for junior Greco-Roman wrestlers in relation to the characteristics of both sports training and wrestling competitions with the purpose of achieving superior performance relied on documentary information taken from sources such as Scopus, Web of Science and Google Scholar.

Other research techniques and methods used are:

• Pedagogical observation - consists of observing wrestlers' fighting behaviour and recording matches to improve their technique. Based on this method, comparisons and delineations were made, and fundamental or detailed aspects related to the improvement of dismantling techniques were highlighted.

• Modelling methods - used to model the behaviour of athletes during training and competition evaluation. The main factors modelled are related to the maximum intensity parameters.

• Experimental method - the article is based on an improved educational experiment to confirm or refute the research hypothesis. The aim of the experiment was to optimize the training of young wrestlers,

focusing on improving their peak strength and performance stats. The test is used to compare training and competition metrics to configure current and future models and specific training.

• Mathematical statistical methods - used to highlight research results, determine relationships between experimental variables and test the differences between two experimental periods and their significance. Therefore, statistical data were processed using Data Analysis software, Microsoft Excel, which calculates the following descriptive data: mean, standard error of the mean, standard deviation, and sum. To demonstrate that the chosen training program produces significant effects on the obtained results, the Student's t-test was applied, with significance set, in our case, at the value value $p < 0.05$ gives $N=10$.

• Graphical method - use to highlight the essential characteristics of the aspects studied and their trends over time.

Participants

The research was carried out between 19 February and 9 September 2022 within the Greco-Roman Wrestling Section of the School Sports Club no. 5 in Bucharest.

The participants (n = 18) of research were divided into two groups (a control group consisting of 9 athletes and an experimental group consisting of 9 athletes). All of them were advanced wrestlers aged between 15 and 17 years (Table 1 and Table 2), competing in the Individual National Greco-Roman Championships.

The ethical and medical conditions were respected for the research participants. The research protocol was approved by the Ethics Committee of the School Sports Club no. 5 in Bucharest (of 16/12.01.2022) and an informed consent was signed by the parents of the athletes participating in the research.

Table 1. Athletes in the experimental group

Item no.	Initials	Weight class (kg)	Age (years)
1.	D.F.	55	16
2.	C.A.	60	17
3.	I.F.	63	16
4.	O.D.	67	17
5.	S.B.	72	16
6.	B.E.	77	15
7.	O.C.	82	15
8.	L.Ş.	87	15
9.	S.C.	97	17

Table 2. Athletes in the control group

Item no.	Initials	Weight class (kg)	Age (years)
1.	V.Ş.	55	15
2.	S.A.	60	16
3.	S.D.	63	16
4.	V.D.	67	16
5.	S.R.	72	17
6.	R.A.	77	15
7.	S.A.	82	17
8.	G.C.	87	15
9.	A.I.	97	17

Procedure

The two groups participating in the experiment were tested for the execution of takedown techniques in friendly competitions organised by the School Sports Club no. 5 in Bucharest.

The training programme for both groups was the same in terms of final goal: learning and improving the takedown techniques and applying them during wrestling competitions.

The difference between the two groups involved in the experiment as regards their training consisted in:

- implementing video analysis lessons in the training of the experimental group;
- using new specific means designed after the biomechanical analysis of the techniques.

The number of lessons in the learning and improvement process was 6 sessions at an interval of two weekly cycles.

The following themes were presented and debated:

- Technical and biomechanical analysis of takedown techniques;
- Analysis of takedown techniques performed during the off-balance actions;
- Defence and counterattack combinations within the takedown techniques;
- Analysis of the forces acting within the wrestler-wrestler system;
- Position and displacement of the centre of mass;
- Correction of execution mistakes made while performing the takedown techniques during various combat actions;
- Study of themed combat actions and competition fights but also of the possibility to perform the takedown techniques.

The themes were addressed within each takedown technique for a more detailed study. The training content was aimed at learning and improving the takedown techniques but also developing the motor skills necessary to perform the technical actions as quickly as possible. In the first part of the training, the technical execution was observed and controlled by engaging the athletes in active participation, which ensured the correct acquisition of even the most complex actions from the very beginning.

In this learning period, the athletes gained knowledge about the correct execution of specific techniques and the use of tactical means. Thus, they acquired the basic mechanism of each technique based on the method of global or fragmented learning, depending on the complexity of the action. The latter involves dividing a technique into logical units, according to which the athlete gradually learns the basic mechanisms of the techniques concerned.

In the case of takedown techniques (Figure 2), this method was only used for learning the takedown by waist lock and balancing, with this latter phase being first improved.

For the other techniques that did not require fragmentation, the instructions were accompanied by precise demonstrations and explanations.

In learning the techniques, the principle of accessibility was also respected, moving from simple to more difficult exercises, thus getting the athletes gradually used to the real competition conditions.

The main methodical exercises used in the experiment for the learning and improvement of takedown techniques were:

- Takedown by direct waist lock:

- From the fight position without contact with the opponent, lunge on the forward leg until it the attacker's shoulder reaches the opponent's abdomen and their chest is on the thigh of the defender's front leg;

- Same exercise by gripping the opponent's belt and passing the head next to their hip.

- Takedown by waist lock and arm wrap:

- Dragging the opponent's arm, waist lock while wrapping their arm;

- From a cross grip, lowering the grip to the waist level and keeping the opponent's arm inside it.

- Takedown by waist lock and lift off:

- From the fight position, encircling the opponent's torso with both arms and lunging until the attacker's shoulder reaches the opponent's abdomen and their rear leg is between the defender's legs;

- From the above grip, lifting the opponent off so that their feet do not reach the mat by bending the trunk from vertical to horizontal and forcing the opponent into the danger position.

- Takedown by waist lock, lift off and balancing:

- From the fight position without contact with the opponent, lunge on the forward leg until the attacker's shoulder reaches the opponent's abdomen and their chest is on the thigh of the defender's front leg;

- Same exercise by gripping the opponent's belt and passing the head next to their hip.

- Takedown by waist lock and lift off:

- The attacker performs a waist lock under both arms of the opponent, brings their rear leg near the forward leg (between the defender's legs), and then lifts the opponent off the mat (by extending their legs and torso);

- By suddenly bending the trunk and kneeling, the attacker overturns the opponent's body until it lies down into the danger position.

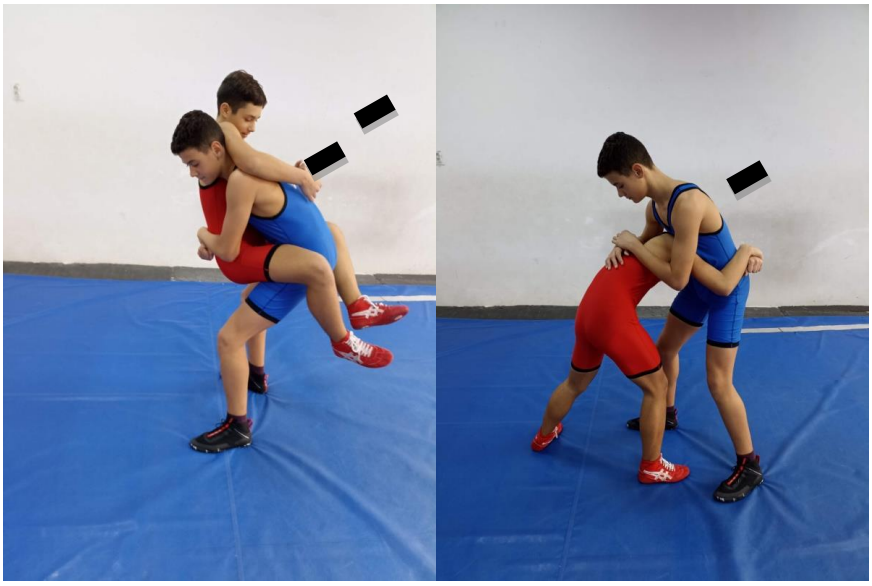


Figure 2. Takedown technical actions

The training content for the improvement of takedown techniques aimed, in its first part, at eliminating unnecessary movements and thus ensure the most rational structure for the tested actions and their execution with minimum energy consumption. This was achieved by:

- Frequently changing the sparring partner;

- Changing the starting positions of the techniques performed;

- Increasing the partner's opposition while performing different phases;
- Developing the specific motor skills necessary for the most effective execution.

The improvement of takedown techniques in combat conditions (themed actions) aimed at:

- Performing the techniques as quickly as possible after the grip;
- Performing the techniques at different moments of the fight (at the beginning, the end), when the teguments offer different adherence;
- Attempting the execution in difficult moments of the fight (against the background of one's own fatigue and the opponent's fatigue);
- Establishing the technical actions and variants that best correspond to the wrestler (in motor and somatic terms).

Results

The process of improving takedown techniques is materialized by testing experimental and control groups at the beginning and end of the research, in friendly competitions to see the weight of these techniques in competitive conditions. The results are shown in Tables 3 and 4.

Table 3. Weight of takedown techniques performed during competitions by wrestlers in the experimental group (initial test and final test)

Item no.	Takedown techniques	No. of technical actions performed Initial test	No. of technical actions performed Final test
1	Takedown by direct waist lock - TKD1	3	4
2	Takedown by waist lock and arm wrap - TKD2	2	3
3	Takedown by waist lock and lift off - TKD3	3	3
4	Takedown by arm push - TKD4	4	4
5	Takedown with headlock and arm lock - TKD5	2	4
6	Takedown with inverted headlock and arm lock and hand clench - TKD6	1	5

7	Takedown with arm lock and body lock - TKD7	2	4
8	Takedown by waist lock, lift off and balancing - TKD8	3	2
9	Takedown with cross grip and hand clench - TKD9	2	4
10	Takedown with body lock and arm lock - TKD10	1	3

Table 4. Weight of takedown techniques performed during competitions by wrestlers in the control group (initial test and final test)

Item no.	**Takedown techniques**	**No. of technical actions performed Initial test**	**No. of technical actions performed Final test**
1	Takedown by direct waist lock - TKD1	2	3
2	Takedown by waist lock and arm wrap - TKD2	1	2
3	Takedown by waist lock and lift off - TKD3	3	3
4	Takedown by arm push - TKD4	3	2
5	Takedown with headlock and arm lock - TKD5	2	3
6	Takedown with inverted headlock and arm lock and hand clench - TKD6	3	2
7	Takedown with arm lock and body lock - TKD7	2	2
8	Takedown by waist lock, lift off and balancing - TKD8	2	3
9	Takedown with cross grip and hand clench - TKD9	3	4
10	Takedown with body lock and arm lock - TKD10	2	2

As a result of recording the matches, athletes in the experimental group approached the fights with more courage, performing a greater number of takedown techniques (Figure 3).

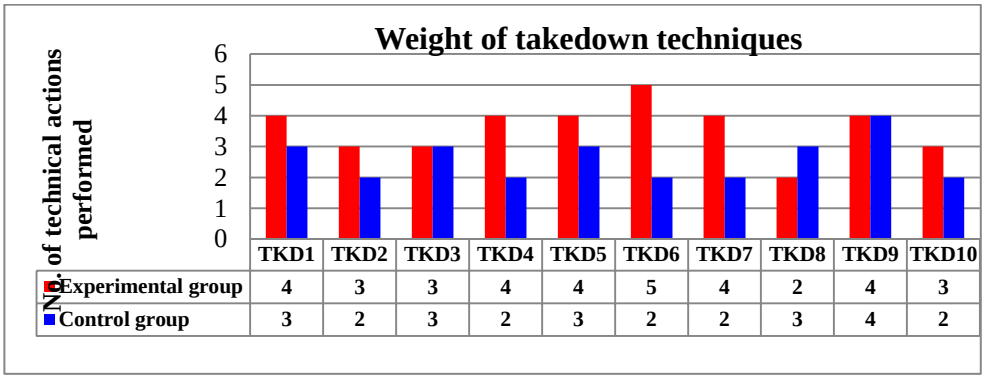


Figure 3. Weight and number of technical actions performed in the final test by the experimental and control groups

The Student *t* Test for Paired Samples was applied to check whether the results obtained by the experimental group were significant (Table 5 and Table 6).

Table 5. Statistical data regarding the weight of knockdown techniques performed by wrestlers in the experimental group

Mean	2.3
Variance	0.9
Observations	10
Pearson Correlation	-0.25
Hypothesized Mean Difference	0
Df	9
t Stat	-2.899
P(T<=t) one-tail	0.009
t Critical one-tail	1.833
P(T<=t) two-tail	0.018
t Critical two-tail	2.262

Table 6. Statistical data regarding the weight of knockdown techniques performed by wrestlers in the control group

Mean	2.3
Variance	0.455
Observations	10
Pearson Correlation	0.282
Hypothesized Mean Difference	0
Df	9
t Stat	-1.152
P(T<=t) one-tail	0.139
t Critical one-tail	1.833
P(T<=t) two-tail	0.278
t Critical two-tail	2.262

The results have representative values for the experimental group as follows:

- arithmetic mean M(x) = 2.3, two-sided critical t = 2.262 and p = 0.018, demonstrating that our approach to optimising engineering training through video analysis of engineering disassembly achieved the desired result.

Moreover, there are significant differences between the average scores obtained in the final test by the experimental group compared to the control group (Table 5 and Table 6).

Discussion

The present study complements the existing information about the optimisation of technical training in Greco-Roman combat sports for junior wrestlers.

In biomechanical terms, wrestling is included in the category of acyclic sports with variable exercise intensity, depending on the rapid change of combat situations.

As regards basic motor skills, their characteristic is that they are performed under strength-speed conditions, in permanent contact with the opponent and according to the opponent's reactions (Hurramovich et al., 2020). Explosive strength efforts with dominant neuropsychological and neuromuscular demands last only a short time but are very intense and occur at irregular intervals (Gierczuk et al., 2018; Cieśliński et al., 2021).

The execution of specific techniques requires skill, strength, reaction speed, execution speed, sense of observation, ability to anticipate the

opponent's movements as well as quick thinking to make effective decisions, all of this in conditions of resistance and depending on the opponent's movements or intentions (Predoiu et al., 2018; Yuldashevich et al., 2022; Nagovitsyn et al., 2019).

Along with courage, toughness, perseverance, will power, stress resistance, emotional balance, intelligence and self-control as indispensable qualities for competitive wrestlers, an increased sense of orientation on the mat, good muscle suppleness and joint mobility but also an increased coordination ability of large muscle groups are required.

In conclusion, we emphasise that it is difficult to analyse training (plus recovery) separately from competition, just as it is impossible to dissociate competition from the training process. Thus, the interdependence between these forms of activity becomes an indispensable condition in elite sport.

Conclusion

This manipulative functional experiment aimed at checking the research hypothesis regarding the improvement of takedown techniques through a series of specific means and the use of video technology in the training of athletes.

The means used (both the video resources and the actual exercises) have led to the improvement of takedown techniques, which is revealed by the results of the tests performed during the experiment.

The use of video aids contributes to the learning and improvement of techniques through the technical and biomechanical study per sequence, but also to a more efficient completion of the body of knowledge about the acquisition of technical actions.

By watching the videos and studying the competitive fight, it was possible to observe the wrestlers' mistakes when performing some techniques in attack, counterattack and defence, which could then be quickly corrected.

We can state that using video resources corresponds to their implementation in the training process as a means of instruction, which confirms the research hypothesis.

The methodology used proved its effectiveness, which was confirmed by the experimental approach. During the experiment, the ability to apply the takedown techniques in competitive conditions increased significantly for the experimental group compared to the control group, thus validating the research hypothesis and the methodology of manipulating the experimental variables.

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Informed Consent Statement: Informed consent was obtained from all subjects involved in the study. Written informed consent has been obtained from the parents to publish this paper.

Authors' contributions

All authors contributed equally to this study and should be considered as main authors.

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