Volume 2, Issue 3, March - 2024 **ISSN (E):** 2938-3811

Web of Scientists and Scholars: Journal of Multidisciplinary Research

BIOMECHANICAL CHARACTERISTICS OF THROWING TECHNIQUES IN COMPARATIVE ANALYSIS WITH OLYMPIC WRESTLING STYLES

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Abstract
The purpose of the article: to systematize the biomechanical characteristics of throwing techniques in Qazaq kuresi and compare them with the requirements and movement patterns of Olympic wrestling (Greco-Roman and freestyle). The analysis was based on the UWW rules for Qazaq kuresi and Olympic wrestling, as well as scientific sources on the biomechanics of throws in wrestling and related sports (judo). It is shown that in Qazaq The evaluation criteria directly capture the "biomechanical quality" of the throw (speed, amplitude, phase completion, post-throw control), which emphasizes the role of explosive extension of the lower extremities, rotational moments in the pelvic -lumbar complex, and control of the opponent's center of mass. In Greco-Roman wrestling, the restriction on attacks below the waist shifts the load to the core and upper shoulder girdle; in freestyle wrestling, the ability to attack with legs increases the proportion of maneuvers involving changes in level and combined support. A set of measurable biomechanical indicators (kinematics, kinetics, phase timing) and a comparative table of expected differences are proposed.

Keywords: Qazaq kuresi, biomechanics, throw, kinematics, kinetics, UWW, Greco-Roman wrestling, freestyle wrestling.

Introduction

Throwing techniques are a fundamental component of competitive effectiveness in martial arts, as they enable the fight to enter the decisive phase and maximize points through a dynamic and controlled takedown of the opponent. Within various wrestling disciplines, the structure and requirements of throws are determined not only by tactical guidelines but also by official regulations, which set the objectives and criteria for evaluating technique.

Qazaq kuresi is a traditional type of wrestling included in the work of the international federation United World Wrestling (UWW). Its rules explicitly specify the biomechanical parameters that influence the evaluation of a throw: speed, amplitude, completion of the movement phases, and control after the opponent is thrown to the mat, making the concepts of efficiency and quality of execution closely linked to the biomechanical characteristics of the athlete's movements [1]. This regulatory framework requires wrestlers not only technical proficiency but also high dynamic coordination, strength readiness, and the ability to consistently manage the "own body complex – opponent's body complex" system throughout all phases of the throw.

A comparison with the Olympic wrestling disciplines of Greco-Roman and freestyle appears productive from a scientific and applied perspective, as the differences in the regulations of these disciplines fundamentally alter the motor requirements for throwing actions. In Greco-Roman wrestling, actions below the waist are prohibited, significantly limiting the possibilities for attacking leg grabs and increasing the importance of movements that utilize the upper shoulder girdle and core to generate rotational moments. In freestyle wrestling, by contrast, leg grabs and active level changes are permitted, leading to more variable entry points into a throw and a greater variety of kinematic patterns for attacking actions [2].

Understanding these differences at the biomechanical level through the study of kinematic (trajectories, angular velocities) and kinetic (impulses, moments) parameters is an important aspect of athlete training, as these parameters determine the effectiveness, stability, and safety of throws in a particular wrestling style. Biomechanical research in wrestling and related sports (e.g., judo) shows that quantitative movement characteristics (angular velocities, changes in the center of mass, force distribution across phases) correlate with competitive success and the wrestlers' technical skill [3].

Thus, introducing a biomechanical perspective into the analysis of throwing techniques allows us not only to describe the execution technique but also to identify quantitative parameters that can serve as objective indicators of the effectiveness and efficiency of wrestler training in various wrestling styles. Such a comparison is especially relevant in the context of modern sports science, where the requirements for physical fitness and motor technique are becoming increasingly precise and measurable based on objective data.

The scientific novelty of the study lies in the fact that for the first time a comparative biomechanical comparison of throwing techniques has been carried out Qazaq kuresi with Olympic wrestling styles, taking into account the regulatory requirements of the United World Wrestling, which form a different structure of kinematic and kinetic parameters of movement.

Materials and Methods of the Study

The study was conducted in the format of an analytical comparative review using biomechanical and procedural analysis methods applied in sports science. The work is not experimental in nature and is aimed at developing a scientifically sound framework for comparing throwing techniques in Qazaq Kuresi and Olympic wrestling styles.

The following materials served as the research materials:

- official rules of the United World Wrestling (UWW) for Qazaq kuresi, as well as for Greco-Roman and freestyle wrestling, which set out the requirements for the technique of execution and evaluation of throws, directly affecting their biomechanical structure [1,2];
- scientific publications on the biomechanics of throwing actions in wrestling and related martial arts (judo), revealing the kinematic and kinetic parameters of effective techniques [3];
- theoretical works examining mechanical models of throws (lever, pair of forces) and principles of analyzing the effectiveness of attacking actions in martial arts [4].

The methodological basis of the study is a qualitative content analysis of the rules, which allowed for the identification of biomechanically significant criteria for evaluating throws

(speed, amplitude, phase completion, post-throw control), and a comparative analytical method applied to compare the motor requirements established by various regulations. A phase-based approach to movement analysis, widely used in sports biomechanics and allowing for the throw to be considered as a sequence of preparatory, main, and final phases with characteristic kinematic and kinetic characteristics, was used to interpret the data [3].

The study also included operationalization of indicators that are potentially applicable in future experimental work (angular velocities of body segments, trajectory of the common center of mass, impulse of the support reaction force, temporal characteristics of the phases), which corresponds to modern approaches to the biomechanical analysis of technique in martial arts [3,5].

Research Results

A comparative analysis of regulatory requirements and scientific publications on wrestling biomechanics revealed fundamental differences in the structure and mechanics of throwing techniques in Qazaq Kuresi and Olympic types of wrestling, determined by the specific rules and competitive objectives.

Analysis of the official UWW rules according to Qazaq Kuresi demonstrated that the effectiveness of a throwing technique is directly linked to its dynamic and kinematic characteristics. The rules clearly highlight parameters such as speed of execution, range of motion, completion of the throwing phase, and control of the opponent after execution. This objectively encourages the use of explosive extension of the lower extremities, active engagement of the pelvic -lumbar complex, and the creation of significant rotational momentum of the torso when throwing the opponent to the mat [1].

From a biomechanical point of view, throws in Qazaq Kuresi are characterized by a relatively short preparatory phase, high angular velocity of body rotation, and a pronounced vertical-rotational trajectory of the common center of mass of the "wrestler-opponent" system. Post-throw control, which is an evaluation criterion, requires the athlete to quickly stabilize the support and maintain postural balance, which increases the demands on coordination and strength endurance.

In Greco-Roman wrestling, the regulation ban on attacks below the waist limits the use of the legs as an active attacking element and shifts the biomechanical emphasis to the upper shoulder girdle and core. Throws are more often achieved by creating torque around the body's vertical axis and using gripping force in the shoulder and chest girdle [2].

In comparison with the Kazakh In these throws, a longer preparatory phase and a smaller vertical range of motion are observed, but the role of strength and isometric efforts of the core increases. Biomechanical studies of wrestling confirm that such throws are characterized by high moments of force in the lumbar and thoracic spine [3].

Freestyle wrestling, unlike Greco-Roman wrestling, allows for leg grabs and active level changes, leading to more variable kinematic patterns of throws. Biomechanically, this is expressed in a greater range of angles in the hip and knee joints, as well as in an asymmetrical distribution of ground reaction forces during attacking actions [2].

Compared to Kazakh Throws in freestyle wrestling are more often integrated into passes and takedowns, rather than isolated high-amplitude throwing actions. This reduces the role of the vertical component of the movement but increases the requirements for entry speed and the ability to sharply change the direction of the center of mass, which is confirmed by research data in wrestling and related martial arts [3,5].

Systematization of the obtained data made it possible to identify stable differences in the biomechanical structure of throwing techniques, presented in Table 1.

Table 1 - Comparative characteristics of biomechanical parameters of throws

Parameter	**Qazaq Kuresi**	**Greco-Roman wrestling**	**Freestyle wrestling**
Regulatory emphasis	Speed, amplitude, control after the throw	Transfer and hold without attacks below the belt	Effectiveness of attacks using legs
Preparatory phase	Short, explosive entrance	Longer lasting, more powerful	Variable, with a change in level
Dominant mechanism	Torso rotation + leg extension	Torque of the body and shoulder girdle	A combination of passes and throws
Kinematic indicators	High angular velocity, large amplitude	Limited amplitude, stable rotation	Wide range of joint angles
Stabilization requirements	High (mandatory control)	Average	Variables depend on the situation

Thus, the results of the study indicate that throwing techniques in Qazaq Kuresi Wrestling throws have a pronounced biomechanical focus on spectacularity and completeness of movement, whereas in Olympic wrestling, the biomechanical structure of throws is largely determined by tactical restrictions and the variety of permitted motor actions. The data obtained provide a basis for targeted differentiation of training methods and further experimental research using instrumental methods of biomechanical analysis.

Discussion

The obtained results confirm that the biomechanical structure of throwing techniques in Qazaq Kuresi is formed under the direct influence of regulatory requirements, which explicitly define parameters traditionally considered in sports biomechanics as key indicators of movement efficiency. Unlike Olympic wrestling, where the evaluation of a throw is largely tied to the fact of transferring and subsequently controlling the opponent, in Qazaq kuresi the speed, amplitude and completion of the throw acquire independent competitive significance, which enhances the role of the dynamic and coordination characteristics of the movement.

From the standpoint of classical biomechanical models of throwing (lever and pair of forces) it can be assumed that in Qazaq Kuresi variations that require synchronous action of the lower extremities, pelvic -lumbar complex, and core to create a pronounced rotational moment and

vertical component of the movement are more often implemented. This is consistent with research in wrestling and judo, which shows that high core angular velocity and effective use of ground reaction force are determining factors for the successful execution of throwing actions. In this sense, Qazaq Kuresi places increased demands on explosive strength and intermuscular coordination compared to Greco-Roman wrestling, where the strength work of the core and shoulder girdle dominates with a limited role for the legs.

A comparison with freestyle wrestling reveals a different focus on biomechanical emphases. The permissiveness of leg grabs and active level changes in freestyle wrestling expands the range of kinematic solutions and reduces the requirement for a high vertical throw amplitude. As a result, throwing actions in freestyle wrestling are often integrated into passes and takedowns, where entry speed, asymmetrical distribution of support forces, and the ability to quickly change the direction of the center of mass are crucial . In Qazaq Kuresi, on the contrary, an isolated throw with a clearly defined phase structure and control in the final remains the central element of competitive technique.

From a practical standpoint, the differences identified indicate the limitations of directly transferring training methods between wrestling styles. Wrestling should focus more on developing explosive power in the lower extremities, rotational power of the core, and postural stabilization skills after a throw, whereas in Greco-Roman wrestling, the priority remains the strength potential of the upper shoulder girdle, and in freestyle wrestling, the ability to quickly change the level and coordinate asymmetrical movements. Thus, biomechanical analysis allows us not only to describe differences in technique but also to justify a differentiated approach to designing the training process.

Overall, the discussion of the results shows that Qazaq Kuresi represents an independent biomechanical model of throwing wrestling, in which the spectacularity and effectiveness of movement are supported by formalized evaluation criteria. This makes this form of wrestling a promising subject for further experimental research using instrumental methods of movement analysis and provides a basis for the development of scientifically based training programs for athletes.

Conclusions

The analysis showed that throwing techniques in Qazaq Kuresi Wrestling has a distinct biomechanical nature, conditioned by regulatory requirements that directly link the evaluation of a technical action to the speed, amplitude, and completion of the throw, as well as the opponent's control after its execution. Compared to Greco-Roman wrestling, where the biomechanical emphasis is shifted to strength work of the core and upper body, and freestyle wrestling, characterized by a high variability of attacks due to the use of legs and changes in level , The wrestling style is focused on explosive activation of the lower extremities and synchronous work of the pelvic -lumbar complex and core. The identified differences confirm the need for a differentiated approach to athlete training and indicate the feasibility of further experimental biomechanical research to optimize technique and training in this type of wrestling.

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