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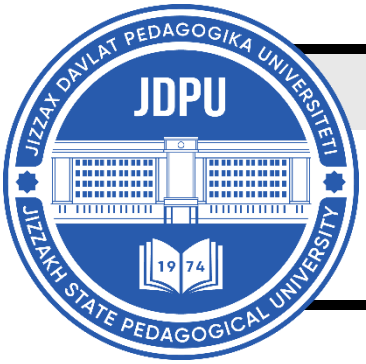


MENTAL ENLIGHTENMENT SCIENTIFIC – METHODOLOGICAL JOURNAL

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# RATE OF INCREASE OF RAPID AND MAXIMUM DYNAMIC STRENGTH ENDURANCE IN VERTICAL CONCENTRIC-ECCENTRIC MODES WITH LOAD IN QUALIFIED WRESTLERS

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## ABOUT ARTICLE

**Key words:** qualified wrestlers, mannequin, rapid strength, maximum strength, endurance, vertical direction, eccentric mode, concentric mode, development.

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**Abstract:** This article analyzes the dynamics of change in rapid and maximum dynamic strength endurance over a one-year training cycle in qualified athletes of certain wrestling styles while performing forward-backward bends and sit-to-stand movements with a 60 kg mannequin within 10 seconds.

**Introduction.** Fundamental research conducted within the framework of sports theory and methodology shows that during complex movements, the need to accelerate, decelerate (or brake), stop, and change one movement into another along sharply changing directions requires specific strength qualities or types of force. Such movements can be performed in concentric, eccentric, isometric, plyometric, or ballistic modes. Force qualities expressed in the eccentric mode are important for slowing down or braking movements (sometimes referred to as “yielding” force). Isometric force or tension is used to stop a movement quickly, concentric force – to overcome resistance (start acceleration), plyometric force – to transition one movement into another, and ballistic force – in the final phase of various movements (final force).

Leading specialists note that when developing strength qualities or types of force, it is advantageous to use exercises with “free weights” or various elastic resistances (barbells,

stones, mannequins, filled balls, etc.). Exercises using such tools allow movements (running, sit-to-stand, bending-stretching, jumping, flexion-extension of arms and legs, etc.) to be performed in any desired or necessary direction and mode. Exercises in this category are natural and allow for the coordinated application of technical-tactical movements [Yu.V. Verkhoshansky, 2021, pp.111-139; L.P. Matveev, 2021, pp.281-301; V.N. Platonov, 2019, pp.268-294; Nuzzo et al., 2008, pp.95-102; Reed et al., 2012, pp.697-706].

In addition to these official data and opinions, it should be noted that in wrestling, the specialized types of force that need to be developed should be refined in accordance with the techniques of competitive methods and their technical components performed in concentric-eccentric modes along vertical-horizontal directions.

Purpose of the study: The study is devoted to examining the dynamics of changes in the types of force expended by qualified wrestlers during forward-backward bending and sit-to-stand exercises with a 60 kg mannequin in vertical concentric-eccentric modes over the course of one annual training cycle (ATC).

Results and comparative analysis: Research shows that in qualified wrestlers, rapid and maximal dynamic strength endurance expressed with a weight in vertical concentric-eccentric modes is not highly developed. For example, the maximum number of forward bends while holding a 60 kg mannequin on the shoulders for 10 seconds at the beginning of the ATC was 6.6±1.03 for belt wrestling, 5.9±0.87 for ethnowrestling, 6.1±1.01 for Greco-Roman, and 5.3±0.82 for freestyle wrestlers. By the end of the ATC, these values increased only to 7.1±1.11, 6.5±1.03, 6.8±1.04, and 6.9±0.85, respectively. In other words, the rapid dynamic strength endurance over 10 seconds in the forward bend test with a 60 kg mannequin increased only by 1.3, 1.2, 1.4, and 1.6 repetitions (see table).

The maximum number of backward bends while holding the mannequin on the chest for 10 seconds was initially 5.1±0.79 for belt wrestlers, 4.6±0.71 for ethnowrestlers, 4.9±0.75 for Greco-Roman wrestlers, and 4.2±0.68 for freestyle wrestlers. By the end of the ATC, these values increased to 6.7±0.86, 5.9±0.73, 6.3±0.78, and 5.5±0.69, respectively, with absolute increases of 1.6, 1.3, 1.4, and 1.3 repetitions (see figure).

**Table:**

Rate of increase over one ATC in the maximum and rapid dynamic strength endurance of qualified wrestlers performing forward-backward bending and sit-to-stand exercises with a 60 kg mannequin on the shoulders and chest, (( X ) ± δ).

| No. | Test | Belt Wrestlers<br>(n=29×2=58) | Ethno-Wrestlers<br>(n=26×2=52) | Greco-Roman Wrestlers<br>(n=25×2=50) | Freestyle Wrestlers<br>(n=23×2=46) |
|---|---|---|---|---|---|
| 1 | Forward bend holding mannequin on shoulders for 10 sec, max reps | 6.5±1.03 → 7.8±1.11 | 5.7±0.87 → 6.9±1.03 | 6.0±1.01 → 7.4±1.04 | 5.3±0.82 → 6.9±0.85 |
| 2 | Backward bend holding mannequin on chest for 10 sec, max reps | 5.1±0.79 → 6.7±0.86 | 4.6±0.71 → 5.9±0.73 | 4.9±0.75 → 6.3±0.78 | 4.2±0.68 → 5.5±0.69 |
| 3 | Sit-to-stand holding mannequin on shoulders for 10 sec, max reps | 8.3±1.79 → 8.9±1.82 | 7.5±1.38 → 8.2±1.42 | 7.9±1.43 → 8.8±1.47 | 7.4±1.40 → 7.9±1.43 |
| 4 | Sit-to-stand holding mannequin on shoulders as many times as possible | 19.8±2.21 → 21.5±2.43 | 18.5±2.14 → 19.6±2.18 | 19.2±2.19 → 20.5±2.36 | 17.8±2.02 → 19.2±2.27 |

*Note: ATC – annual training cycle; the first value corresponds to the beginning of the ATC, the second value – to the end of the ATC. Only wrestlers weighing 68–73 kg were included in the study, and the results were not analyzed by weight category.*

A comparative analysis of the test results shows that, at the beginning of the annual training cycle (ATC), the indicators reflecting the rapid dynamic strength endurance were, first, insufficient for skilled wrestlers, and second, by the end of the ATC, these indicators had not increased at a significant rate. Notably, although in nearly all wrestling styles the elements involving lifting the opponent vertically in a concentric mode and lowering them in an eccentric mode are repeated many times during competitions, such movement elements reflecting rapid dynamic strength endurance were not adequately developed in these wrestlers. Undoubtedly, this situation can negatively affect the effectiveness of technical techniques performed during competitive bouts.

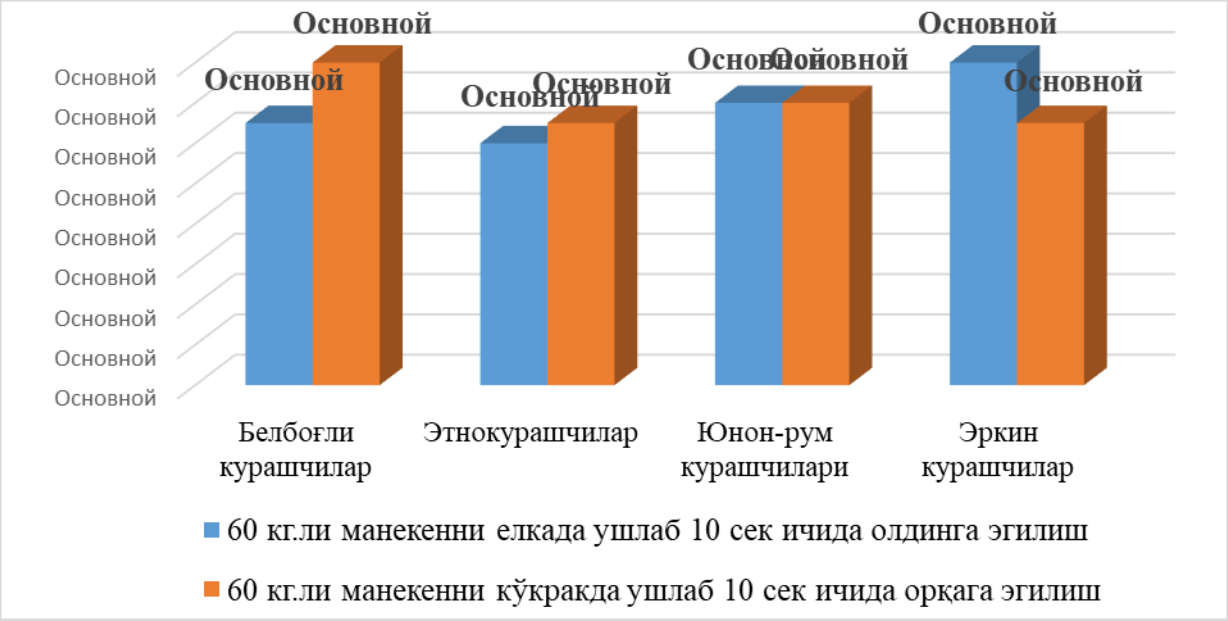


Figure. Diagrams showing the absolute increase in the indicators from the beginning to the end of the training year (ATC) for skilled wrestlers in different wrestling styles, measured by the maximum number of forward-backward bends in 10 seconds while holding a 60 kg mannequin on the shoulders and chest.

It is well known that in wrestling, lifting an opponent in the vertical direction in a concentric mode and lowering or pressing them in an eccentric mode depends on rapid and maximal dynamic strength endurance. The effective execution of such technical elements relies on the strength of the muscles that bend and extend the spine, torso-pelvis, and hip joints. However, research results show that in the group of skilled wrestlers involved in this study, these muscles were developed at a very “weak” level.

Specifically, the maximum number of sit-ups in 10 seconds while holding a 60 kg mannequin on the shoulders at the beginning of the training year (ATC) was 8.3±1.79 for skilled belt wrestlers, 7.5±1.38 for ethnowrestlers, 7.9±1.43 for Greco-Roman wrestlers, and 7.4±1.40 for freestyle wrestlers. By the end of the training year, these values increased to 8.9±1.82, 8.2±1.42, 8.8±1.47, and 7.9±1.43, respectively. In other words, their absolute growth over the training year was still relatively low. The absolute increase in rapid dynamic strength endurance in this sit-up test over 10 seconds was 0.6 repetitions for belt wrestlers, 0.7 for ethnowrestlers, 0.9 for Greco-Roman wrestlers, and 0.5 for freestyle wrestlers.

The maximum number of sit-ups in 10 seconds while holding the 60 kg mannequin on the shoulders as much as possible was 19.8±2.21 for belt wrestlers, 19.2±2.19 for Greco-Roman wrestlers, and 17.8±2.02 for freestyle wrestlers at the start of the training year. By the end, these indicators did not show rapid growth for any wrestling group and reached 21.5±2.43, 19.6±2.18, 20.5±2.36, and 19.2±2.27, respectively. Comparative analysis shows that the

maximum number of sit-ups in 10 seconds while holding the 60 kg mannequin is significantly higher than the forward-backward bending movements under the same conditions. This suggests that in wrestlers, the strength of the hip and knee flexor-extensor muscles is more developed than that of the spine-pelvis flexor-extensor muscles. In our view, increasing the strength of the spine-pelvis flexor muscles is also important from the perspective of lifting and throwing an opponent.

It is also important to note that the rapid and maximal dynamic strength endurance used in forward-backward and sit-up movements under the influence of weight in concentric-eccentric mode in the vertical direction was more developed in belt wrestlers compared to representatives of other wrestling styles. It can be assumed that this is because in belt wrestling, the opponent's arms are constantly "locked" on the belt during bouts, and the wrestlers regularly perform exercises involving lifting and lowering weights, which contributes to the higher development of vertical strength.

Nevertheless, for all wrestlers, the development of strength types executed in concentric and eccentric modes in vertical-horizontal directions should be proportional and, ideally, symmetrical. In other words, strength development specific to wrestling styles, which have unique competition rules and coordination characteristics, should primarily correspond to the technique, biomechanics, and kinematic parameters of the applied wrestling methods, regardless of weight category.

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