Special endurance of highly qualified judoists and the method of its quantitative assessment in preparation for responsible competitions

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Abstract

Objective of the study was to substantiate methods for assessing the level of development of special endurance of wrestlers on the basis of a comprehensive definition of pedagogical and biochemical indicators characterizing the effectiveness of performing a standard specific task with throws of a wrestling dummy.

Methods and structure of the study. As a result of exploratory research, the author developed a standardized test program with deflection throws of a wrestling dummy and a criterion for quantifying the level of special endurance of judo wrestlers. Based on the results of long-term observations of the dynamics of special endurance of highly qualified judoists, guidelines for a quantitative assessment of the special endurance of athletes at various stages of training are proposed. The author notes that the program of precompetitive training of wrestlers should be focused on achieving a level of special endurance that exceeds the limit value of the coefficient of special endurance (CSE) of more than five conventional units. With this level of special endurance, the load of a competitive duel does not lead to a pronounced activation of anaerobic glycolysis. The pH values after the fight will be in the optimal values (7.2-7.27 c.u.).

Keywords: *judo, peak sports form, competitive activity, special endurance, blood pH, lactate.*

Introduction. The results of the performance of highly qualified judokas are largely determined by the quality of the construction of the final stage of training, which provides for the achievement of the peak of sports form by the time of participation in important international competitions. Such a state (peak of sports form) is closely related and determined by the dynamics of the level of special endurance of athletes.

This fact determines the relevance of monitoring the level of special endurance of judo wrestlers, since higher absolute values of this indicator predetermine a less acute nature of the physiological reaction of athletes to the load of a competitive duel [3, 9].

From earlier studies [4, 8] it is known that a judoka with a higher level of special endurance has significantly lower acidotic shifts, reaching values in pH up to 6.85 c.u. (or lower values of lactate concentration in the blood up to 30 mmol/l) after the end of the fight (non-linear correlation coefficient (η=0.98).

This indicates that selective laboratory testing of only individual indicators characterizing the level of development of aerobic or anaerobic capabilities does not allow a reliable assessment of the special performance of wrestlers and can lead to incorrect conclusions and erroneous recommendations.

Objective of the study was to substantiate methods for assessing the level of development of special endurance of wrestlers on the basis of a comprehensive definition of pedagogical and biochemical indicators characterizing the effectiveness of performing a standard specific task with throws of a wrestling dummy.

Methods and structure of the study. Until now, the assessment of the level of special endurance of judo wrestlers has often been of a qualitative nature, based on the athlete's subjective feelings of the degree of his readiness for competitions according to the principle - ready or not ready. This indicates that at present there is an acute problem of searching for informative criteria for evaluating the effectiveness of the means and methods used for precompetitive training of qualified judokas.

In the practice of sports, this problem is solved in two ways:

– by accurate quantitative assessment of the level of development of individual metabolic functions of athletes during in-depth examinations using standard laboratory tests [6, 7, 9, etc.];

– by evaluating the manifestation of athletes' bioenergetic potentials under conditions simulating specific competitive activity and giving an integral quantitative assessment of the athlete's special endurance level [2, 5, etc.].

It is known from sports practice that the use of only laboratory tests does not allow a sufficiently reliable assessment of the level of special endurance. This is due to the fact that the potential capabilities of an athlete's body, determined under conditions of a strictly regulated laboratory load, do not necessarily manifest themselves to the same extent when performing specific competitive loads [3, 4, 9, etc.].

Taking this into account, we can conclude that the greatest amount of useful information can be obtained only when using specific loads that simulate the conditions of the upcoming competitive activity, typical for a judo duel.

Experimental substantiation [1-3, 6, etc.] was applied both to various means of modeling the competitive load (exercises of a special preparatory nature, throws of wrestling dummies, throws of one or several partners, etc.), and various methods of testing (exercises different in terms of work time, intensity, number of repetitions, etc.).

It has been established that for assessing the special endurance of wrestlers, the most appropriate is a five-minute test procedure performed after the usual training warm-up, which includes throwing a dummy through the chest (Yoko Guruma) weighing 1/3 of the weight of the athlete [2].

After a five-seven-minute rest, athletes perform the main testing task:

– on a signal, at regular intervals, the wrestler performs four mannequin throws through the chest (Yoko Guruma) in 40 seconds (background load);

– after the end of the background load, on a signal, the athlete performs eight mannequin throws through the chest (Yoko Guruma) at the maximum pace, with an accurate determination of the time (per second) for completing the task (spurt).

These tasks are performed in the specified sequence five times in a row.

When developing a special testing procedure, it was assumed that three mandatory conditions would be met: specific (according to the biomechanics of performing a motor action) nature of the load; physiological comparability of the load of a competitive duel and a test; strictly regulated and reproducible load simulation mode, simulating a competitive duel.

Based on the results of studies of the bioenergetic structure of the special endurance of judo wrestlers [3, 4, 8, 9, etc.], in which it was shown that glycolytic anaerobic capabilities significantly limit the special endurance of wrestlers, it was proposed to assess the degree of realization of the functional capabilities of athletes by the value of acidotic shifts or values of lactate concentration in the blood after the test.

Studies conducted on qualified judoists have shown that a five-minute special test causes comparable (with the conditions of a competitive duel) changes in the acid-base balance of the blood [2]. The average value of the indicator of acid-base balance of blood taken from the tip of a heated finger at the third minute of rest after the end of the test was 7,1±0,07 (the lowest value of pH=6.95). In addition, it should be noted that the values of acidotic shifts found after performing a special test were equal (differences are statistically unreliable with $p>0.05$) to shifts in blood pH after performing the limiting bicycle ergometric load of glycolytic anaerobic orientation (Wingate test), carried out under the conditions of a laboratory experiment [1, 3, 9].

Results of the study and their discussion. When developing a criterion for assessing the level of special endurance of judo wrestlers, we proceeded from the following premises:

a) the value of the special endurance of a judoist is inversely proportional to the total time of performing five series of throws of a wrestling dummy in sprint tasks ($1/\Sigma t$). This means that the less time a wrestler spends on performing a standardized test task, the more special endurance he has;

b) the value of the special endurance of a judoka is inversely proportional to the value of the value of acidotic shifts (ΔpH) caused by the performance of a standard specific load ($1/\Delta pH$), that is, the smaller the value of acidotic shifts (ΔpH = pHinitial - pHafter the test) after testing, the higher the special athlete endurance.

Based on the above, a formula was proposed for calculating the coefficient of special endurance (CSE) for judo athletes.

For a quantitative assessment of the level of special endurance, the value of the value of the coefficient of special endurance was used, determined by the formula:

Normative values of the level of special endurance (CSE) qualified wrestlers of light, medium and heavy weight categories

Weight wrestlers	The level of development of special endurance (CSE values in arbitrary units)				
	Very low	Low	Medium	High	Very high
Lightweights	< 2.5	≥ 2.5 < 3.5	≥ 3.5 < 5.5	≥ 5.5 < 6.5	≥ 6.5
Middleweights	< 2	≥ 2 < 3	≥ 3 < 5	≥ 5 < 6	≥ 6
Heavyweights	< 1.5	≥ 1.5 < 2.5	≥ 2.5 < 4.5	≥ 4.5 < 5.5	≥ 5.5

$$CSE = \frac{100}{\Sigma t \cdot \Delta pH},$$

where: 100 is a numerical coefficient introduced for the convenience of calculations;

Σ t (s) is the total time of the mannequin throws through the chest (Yoko Guruma) in five series of spurt tasks (Σ t = t1+t2+t3+t4+t5);

Δ pH - the value of acidotic shifts caused by the performance of a special test.

From sports practice, it is known that for urgent monitoring of the reaction of athletes to high-intensity physical activity, a biochemical method for assessing blood lactate is often used. In this regard, we have modified the CSE calculation formula, which makes it possible to obtain comparable values of this indicator, regardless of the method of biochemical assessment of the response of the athlete's body to physical activity. This version of the formula looks like:

$$CSE' = \frac{4600}{\Sigma t \cdot \Delta lactat},$$

where: 4600 is a numerical coefficient introduced for the convenience of calculations and obtaining comparable CSE values;

Σ t is the total time (s) for performing mannequin throws through the chest (Yoko Guruma) in five series of spurt tasks (Σ t = t1+t2+t3+t4+t5);

Δ lactat is the value of acidotic shifts caused by the performance of a special test (Δ lactat = lactatafter the test - lactatinitial).

As shown by the results of many years of pedagogical observations of highly qualified wrestlers, the determination of CSE allows not only to accurately assess the level of development of special endurance of judo wrestlers, but also makes it possible to predict the performance results of these athletes in important competitions.

On the basis of the conducted studies, normative values of the SWR of qualified judokas were developed, which quantitatively characterize the level of development of special endurance of athletes at various stages of preparation for important competitions, presented in the table.

It should be noted that the proposed method for evaluating the special endurance of wrestlers (CSE) makes it possible to assess the level of an athlete's preparedness with a high degree of accuracy. However, the obligatory use of biochemical equipment (assessment of pH or lactate in the blood) during the test significantly limits the practical use of this criterion. In this regard, the assessment of the SWR of judokas can be carried out when conducting exploratory scientific research and when working with highly qualified athletes of national teams.

Conclusions and practical recommendations:

- A test procedure and a formula for calculating the special endurance coefficient of judo wrestlers based on a comprehensive assessment of pedagogical and biochemical (pH or blood lactate) indicators are proposed.
- Based on the results of long-term observations of the dynamics of special endurance of highly qualified judoists, guidelines for a quantitative assessment of the special endurance of athletes at various stages of training are proposed.
- The wrestlers' precompetitive training program should be focused on achieving a level of special endurance that exceeds the limit value of CSE over five conventional units. With this level of special endurance, the load of a competitive duel does not lead to a pronounced activation of anaerobic glycolysis. The pH values after the fight will be in the optimal values (7.2-7.27 conventional units.).
- The state of the peak of sports form, which allows to successfully perform at important competitions, can be achieved with SWR values in the range from 7 to 10 conventional units.

References

1. Volkov N.I., Shiyan V.V. Anaerobnye vozmozhnosti dzyudoistov i ih svyaz s pokazatelyami sorevnovatelnoj deyatelnosti [Anaerobic abilities of

judo wrestlers and their connection with indicators of competitive activity]. Teoriya i praktika fiz. kultury. 1983. No. 3. pp. 23-25.
2. Shepilov A.A., Klimin V.P. Vynoslivost borcov [Endurance of wrestlers]. Moscow: Fizkultura i sport, 1979. 142 p.
3. Shiyan V.V. Teoreticheskie i metodicheskie osnovy vospitaniya specialnoj vynoslivosti vysokokvalificirovannyh borcov [Theoretical and methodical bases of education of special endurance of highly qualified wrestlers]. Doct. diss. abstract (Hab.). Moscow, 1998. 41 p.
4. Shiyan V.V., Nevzorov V.M. Teoriya i praktika rossijskogo dzyudo: kakovy perspektivy integracii? [Theory and practice of Russian judo: what are the prospects for integration?]. Teoriya i praktika fiz. kultury. 2005. No. 5. pp. 19-25.
5. Azevedo P.H., Drigo A.J., Carvalho M.C., Oliveira J.C., Nunes J.E., Baldissera V., et al. Determination of judo endurance performance using the uchi-komi technique and an adapted lactate minimum test. J. Sports Sci. Med. 6, 10-14. (2007).
6. Dill D.B., Robinson S., Ross J. A longitudial study of 16 champion ranners. Sport Med. Phys. Fitnes, 1967. No. 7. pp. 4-27.
7. Pulkkinen W.J. The sport science of elite judo athletes, Pulkinetics Inc. 2001, 93 p.
8. ShiyanV.V. Bioenergetic factors determining the development of special endurance of wrestlers. International Journal of wrestling science, 2012. Vol. 2 No.1. pp. 17-20.
9. Wolkow N., Shiyan V. Bioenergetyczne kryteria oceny wytrzymalosci specjalnej zawodnikow w sportach walki In: Wybrane zagadnienia kontroli procesu treningu w sporcie wyczynowym. Warszawa, Alma-Press, 2000. pp. 200-225.