

# Fitness level of male competitive judo players

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## Summary

**Introduction.** Judo is the sport in which movements are powerful, delivered in a short period of time, usually against the force of the opponent. Consequently, the main energy sources are high energy phosphates and the glycolytic pathway.

**Material and methods.** The aim of our study was to determine fitness level of 28 male competitive judo players from Serbia. We decided to evaluate fitness levels of judo players by measuring their muscular strength and anaerobic capacity. These were determined using a dynamometer and standard Wingate (WAnT) testing protocol.

**Results.** The measurement of muscle strength in the upper and lower limbs revealed increasing values throughout the weight categories (flexed arm strength  $78 \pm 4.4$  kg; extended arm strength  $76.6 \pm 5.1$ ; extended leg strength  $168.3 \pm 15.9$  kg), yet in relative numbers (muscle strength/body weight) the highest values were obtained from the middle categories. WAnT results (peak power  $767.3 \pm 74.4$  W; mean power  $654.2 \pm 39.8$  W; fatigue index  $38.6 \pm 6.6$  %) among the categories are similar to the values obtained for muscle strength and the highest relative values were 73kg and 81kg and 90kg respectively.

**Conclusions.** Due to the similar test results of medal winners from World and European Championships it is necessary to further improve fitness level of our athletes.

## Introduction

Nowadays Judo is becoming a more and more demanding sport, both physically and mentally. According to this it is necessary to pay special attention to physical preparation for the competition. During training and competition, the human body uptakes energy for the activities, depending on their intensity and duration. Research has shown that the energy for muscle activity in judo is predominantly derived from anaerobic sources. Dal Monte [1] suggests that of adenosine triphosphate (ATP) replenishment comes from creatine phosphate (CP) in 90 %, and lactate glycolytic pathway up to 10 %. It is also well documented that muscle strength represents one of the most important motor abilities in Judo as a sport.

The Judo coaches choose training methods and tools according to each competitor's weight category and fighting style. In order to make good training protocol it is also necessary to understand the energy pathways during a short term judo fight of high intensity.

Functional diagnostics in Judo means determining and measuring the abilities which are important and influence sport results. During the initial training process and transition period, the final measurements are performed to monitor the effects, and modify the training course order to achieve the desired training goals.

The aim of our study was to determine the fitness level (anaerobic capacity and muscle strength) in the group of judo players during adaptation to a long-term sport training. The secondary goal of the study was to compare the findings and observe the differences between each weight-category.

## Material and methods

### Subjects sampling

28 male judo players with a long history of practising judo participated in the study (Table 1.). All the participants were national level ranked judokas.

### Measurements

The following parameters were measured:

- Body weight (BW)
- Body height (BH)
- Age
- Sport history
- Peak power
- Mean power
- Fatigue index
- Peak power/ body weight

- Arms strength – flexion
- Arms strength – extension
- Leg strength – extension

## Procedure

Our research was based on the experimental procedure in order to investigate anaerobic properties and muscle strength of national level judokas. All testing procedures (dynamometric and Wingate test) were performed at the Laboratory for Functional Diagnostics, Department of Physiology, Medical Faculty in Novi Sad. All tests were carried out in the morning, according to the standard protocol – Wingate anaerobic test (WAnT), for measuring anaerobic capacity [2]. Strength tests were conducted using the „Dyno – Concept 2000” device. The subjects were to perform maximum five repetitions of upper limb flexion and extension and lower limb extension. The average value was recorded. All procedures were carried out by the same team. The experimental protocol was undertaken at the beginning of the basic preparatory phase of the participants.

## Results

In our research, we measured fitness level (anaerobic capacity and muscle strength) of the group of 28 national level male judo players. In Judo, one fight lasts for 5 minutes. This put the fighter into very demanding situation due to high-

ly specific motor and cognitive tasks. The situation is even worse since all techniques are to be done against the resisting opponent. All attack and defence actions are performed in a very short period of time with maximal intensity. In skeletal muscles, energy for such activities is released without the presence of oxygen, energy is predominantly provided by high energy phosphates and lactic–glycolytic pathways [3].

The values of peak power show a linear increase, except for the 90 kg category which is slightly higher (Table 2). Mean power values are somewhat lower compared with peak power values, but this is due to the fact that mean power represents the mean value for a 5 second interval. Fatigue index in all categories is rather high compared with some other findings [4]. One of the interesting findings of anaerobic capacity testing is that the relative values of peak power do not meet the necessary requirements for the high level, medal winning judokas, especially those in -60 kg, -66 kg, -100 kg and +100 kg weight categories.

Table 3. presents the results of the muscle strength tests. All the values steadily increase over the categories.

Interestingly, there is a disproportion between arm flexion and extension, as higher values are obtained for arm extension in all categories. This may be due to the fact that testing using such a dynamometer is specific by conditions, and the results of our tests are up to 10 % lower compared with 1RM of individual athlete strength for each tested muscle group.

Tab. 1. Physical characteristics of the subjects

Weight category (kg)	Body mass kg (BM)	Body height cm (BH)	Age (yr.)	Sport history (yr.)
- 60 (N=3)	59.3±0.7	167±3.5	16.8±1.2	7±2
- 66 (N=4)	64.2±0.7	169±3.8	20.5±2.3	11.2±2
- 73 (N=5)	70.5±2.5	175±4.5	22.4±4.2	9.5±2
- 81 (N=4)	79.5±2.3	183±3.1	21.9±0.9	11.3±3
- 90 (N=4)	87.5±1.9	183±3.2	22.5±3.1	9.3±3
- 100 (N=5)	96.7±2.2	186±1.9	21.6±3.2	8.4±4
+100 (N=3)	112±9.4	188±4.1	20.7±4.2	8.5±3

Tab. 2. Values of WAnT

Weight category (kg)	Peak power (W)	Mean power (W)	Fatigue index (%)	Peak power/BW (W/kg)
-60 (N=3)	557±34.2	433±23.3	37.1±0.9	9.3±0.6
-66 (N=4)	625±52.8	565±42.1	39.5±1.6	9.7±0.9
-73 (N=5)	722±128	634±65.6	37.6±1.7	10.3±1.8
-81 (N=4)	826±120	679±89.3	40.9±1.4	10.4±1.4
-90 (N=4)	883±137	712±101.3	34.8±1.8	10.1±1.7
-100 (N=5)	856±105	754±122.6	39.1±2.2	8.9±0.9
+100(N=3)	902±183	803±147.1	41.2±1.4	8.1±1.1

Tab. 3. Values of isokinetic strength testing

Weight category (kg)	Arm flexion (kg)	Arm extension (kg)	Leg extension (kg)
-60 (N=3)	56.4±2.1	62.5±3.1	143.2±2.2
-66 (N=4)	60.2±3.4	63.8±2.5	155.4±4.2
-73 (N=5)	65.3±2.8	68.7±3.5	160.2±3.6
-81 (N=4)	71.6±5.3	78.2±1.9	164.4±5.7
-90 (N=4)	80.7±5.2	81.3±3.1	173.2±4.3
-100 (N=5)	97.3±4.8	101.2±3.9	203.1±6.8
+100(N=3)	110.3±7.5	113.1±4.6	217.2±7.2

## Discussion and Conclusions

W. L. Lin et al. [5] have found maximal values of peak power of  $9.18 \pm 0.18$  W/kg in elite Taekwondo fighters. Also, Sharp and Koutedakis [4] have measured values of peak power in British national team judo players which were, on average,  $10.6 \pm 0.9$  W/kg. At the same time Mickiewicz [6] reported mean values of peak power in Polish elite judokas of  $11.42 \pm 1.6$  W/kg. Our results (Table 2) show slightly lower values (peak power  $767.3 \pm 74.4$  W; mean power  $654.2 \pm 39.8$  W; fatigue index  $38.6 \pm 6.6$  %), which, together with the results of muscle strength tests, show the undertrained characteristics compared with medal winners' results. According to our findings, we propose changes in training protocols of this group

of competitors, in order to achieve fitness level appropriate for medal winning.

In training process, it is necessary to develop sport specific abilities, which are going to affect the sport result. To evaluate anaerobic properties in Judo it is appropriate to use WAnT lasting 30 seconds; it is also necessary to evaluate muscle strength (Table 3) since it is one of the basic abilities in Judo as a sport.

According to these tests we can provide enough information about fitness level of the competitors and adjust training protocol to achieve maximal performance level in order to obtain the best possible sport result.

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