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# PLANNING OF EFFORT PARAMETERS IN THE TRAINING OF ELITE MALE JUDO ATHLETES

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**Aim.** The aim of this study was to evaluate the influence of effort parameters on the indicators of fitness tests according to the relation of the variables of training components in judo. **Material and methods.** Application of methods and basic directionality: repeated in series (adaptation), gradually repeated (optimum training state) and competitive (stereotypes). An experimental methodology of the specific training means was planned with 6 athletes monitored over 3 training mesocycles (MzC-s): basic, competitive 1 and competitive 2. The fitness tests checked the biological training (BT), physical training (PT), technical training (TT), technical and tactical training (T-TaT). The performances in two national competitions were also monitored. Parametric tests were conducted with a significance level of $p \leq 0.05$. **Results.** The study results confirm the achievement of the training and performance objectives planned for each training MzC and the improvement of judokas' BT, PT (16.67 % in basic and competitive MzC 1 and 12.63 % – competitive MzC 2), TT (41.66 % in basic MzC), tactical training (25 % in basic MzC) and T-TaT (66.66 % – competitive MzC 1 and 87.37 % – competitive MzC 2). The results of the correlative analysis between the 12 studied indicators reveal 24 significant correlations out of 91 correlations in the basic MzC (26.37 %), 26 correlations out of 91 in the competitive MzC 1 (28,57 %), and 24 correlations out of 78 in the competitive MzC 2 (30.77 %). **Conclusion.** These results show that the effort parameters influenced the judokas' training improvement and the performance capacity increase.

***Keywords:*** *combat sports, fitness tests, planning, training components, statistical and performance analysis.*

**Introduction.** The training in judo tries to develop the athletes both physically (motor skills focusing on the explosive speed in strength and endurance conditions) [29, 30, 40] and mentally (courage, speed of decision-making, perseverance, will to win, boldness, fighting spirit, strategy of applying the technique) [27, 46]. The value of the combat sports training in stages depends on the motor skills and workout volume and intensity as main components of the specific training meant to lead to valuable results set through the performance objectives [24].

Periodization and structured training models are prominent concepts in the field of sports science [19, 37, 52]. The planning of judo training includes: dynamics of performance capacity evolution; structure of exercises; methods of training; volume and intensity of effort; duration and nature of breaks; zone of energetic changes; estimated value of stresses; forms and places of the training; forms and data of evaluation; duration of each component [22, 23, 39]. The sports effort in judo has a very complex content, involving the physical, biological and mental spheres which lead to the achievement of the final objective. Therefore, the effort in judo must be correlated with the current effort capacity of each athlete and the individual features (physical, physiological and mental ones) [16].

During the workouts, the dynamics of effort involves the continuous development of the training process and the permanent progress by gradual increase of all its parameters that always tend towards maximum values. The dynamics of effort parameters entails the determination of the best ratio between effort volume and intensity. Thus, the dynamics of efforts in the first stage of training is characterized by the gradual increase of volume and intensity, especially the growth of effort volume [2, 4, 19, 20, 23]. The correlation between the effort dynamics in microcycles, mesocycles and macrocycles is expressed by

the interactions between the physiological, biomechanical and psychological processes, determined by effort value and fatigue level but also by the rest and recovery [12, 34, 42, 44, 50, 53]. The knowledge of competition functions, regulations evolution and performance validation criteria enables the modeling of the training and competition in combat sports [9, 45, 47].

Many different tests of physical fitness have been used in the evaluation of performance in combat sports athletes [32, 41]. Accordingly, numerous judo-specific diagnostic tests have been developed to not only evaluate athlete skill level and response to intervention, but also to help with the design of strength and conditioning programs [3, 14, 15, 43, 51]. The aim of this paper is to analyze the relationship of effort parameters in the training of elite male judo athletes (judokas) and the relationship of the indicators of elite judokas' training components.

**Materials and Methods**

***Subjects***

Six elite judo athletes participated in this study. They competed in the following weight classes, according to the Competition Regulations of the Romanian Judo Federation: 1 athlete in the under 60 kg class (U-60), 2 in the U-81, 1 in the U-90 and 2 in the U-100. All these judokas were selected from "Steaua" Army Sports Club of Bucharest, Romania. The mean and standard deviation for their age and the body mass (BM) were 27.33 ± 7.66 years, and 87.33 ± 18.08 kg. The subjects volunteered to take part in this study after they had been fully informed about the testing requirements and conditions. All procedures used in this study are consistent with the Declaration of Helsinki on the Research Involving Human Subjects and were approved by the Ecological University of Bucharest – the Committee for Research Ethics and Academic Professional Deontology.

***Procedures***

The study was conducted over 7 months (January to June 2018) in three stages and training mesocycles (MzC): initial testing (IT) – basic MzC (January - February, 2018); intermediate testing (I-MT) – competitive MzC 1 (March 2018, participation in the Individual National Championships for Seniors and Open) and final testing (FT) – Competitive MzC 2 (June 2018, participation in the Romanian Cup and Ne Waza Seniors). An experimental methodology was planned in each training MzC to monitor the dynamics of effort parameters, the achievement of the training objectives and the relation of the training means.

Basic MzC, (120 min): TAISO (20 min); general physical training (GPT) (20 min): strength circuit; technical training (TT), (50 min): using the training methods called UCHI-KOMI and NAGE-KOMI, with SEOI-NAGE, O-UCHI-GARI and O-SOTO-GARI techniques, combinations of the preferred techniques by means of RENRAKU-WAZA; tactical training (TaT), (30 min): RANDORI NAGE-WAZA changing the partner with a partner of different size.

Competitive MzC 1, (90 min): TAISO (15 min); specific physical training (SPT), (15 min, 30–45 sec pause between sets): UCHI-KOMI – reps with resistance band SEOI-NAGE (3×10 sec), TANDOKU-RENSHU – reps of the preferred technique without partner (5×10 sec), UCHI-KOMI – reps with partner, without throwing him (5×10 sec), NAGE-KOMI- reps of the preferred technique with partner's throw (3×20 sec); technical-tactical training (T-TaT), (60 min, 30–45 sec pause between sets): BUTSUKARI-GEIKO – study of technique or combinations with non-resisting partner and with partners' changing (5×2 min), YAKU-SOKU-GEIKO – repetition of T-Ta combinations with partner in movement, with partner's changing (5×2 min), RANDORI with imposed theme – free training fight with partner and completion of the T-Ta actions when perfectly executed, changing the partner (5×2 min), RANDORI in NAGE-WAZA – standing fight with partner's changing, maintaining the score obtained without penalties (5×2 min) and SHIAI – almost competition-like combat, keeping the score without penalties and changing the partner (5×2 min).

During the Competitive MzC 2, (95 min): TAISO (12 min); the SPT is achieved by working with opponents specifically or throughout the entire training session; the T-TaT (75 min, 30–45 sec pause): RANDORI NAGE-WAZA – standing fight with different size partners (5×5 min), RANDORI NE-WAZA – fight on the floor with different size partners' changing (5×5 min) and SHIAI – competition-like combat respecting the competitive regulations (with referees) (5×5 min).

***Fitness tests***

Physical training (PT): PT1 – arm tractions grabbing the judo tunic (max. reps no.); PT2 – semi-squats with weights depending on the training level; semi-squats with partner in the final testing of KATA – GURUMA technique (max. reps no.) – the exercise is executed with partner

of the same weight; PT3 – head bridges with load (max. reps no.) and PT4 – crossover crunches from supine position with arms up and legs on the rib stall (max. reps no.).

Technical test events (TTE): TTE1 – UCHI-KOMI with elastic band in SEOI-NAGE (KOSHI-WAZA) technique – the elastic band (rubber band) is fastened to the rib stall at athlete's shoulders level and the SEOI-NAGE technique (throwing over shoulder) at maximum speed (max. reps no. in 10 sec); TTE2 – UCHI-KOMI – reps in TOKUI-WAZA (favorite technique) with partner, without throwing this one (max. reps no. in 15 sec) and TTE3 – NAGE-KOMI – execution of TOKUI-WAZA (preferred technique) with partner throwing, executed on the favorite side with 4 partners at a distance of 2 m from each other in a square formation (max. reps no. with which is obtained IPPON – 10 points, in 30 sec).

Technical-tactical training events: T-TaTE1 – RANDORI in NE-WAZA –training free fight on the floor, using OSAE-WAZA, SHIME-WAZA and KANSETSU-WAZA techniques for 2 minutes, changing 3 partners (sum of points in 3 matches), T-TaTE2 – RANDORI in TACHI-WAZA – training standing free fight, using the attack and counter-attack tactical and technical techniques, along 2 minutes, changing 3 partners (the ranking is made by cumulating the points obtained in 3 matches) and T-TaTE3 – SHIAI – training fight respecting the regulations and scoring of the official judo competitions, along 2 minutes, changing 3 partners; the ranking is made by totalizing the points obtained in 3 matches.

***Statistical analysis***

All statistical tests were processed using KyPlot software, Version 5.0.3, 1997–2017 KyensLab Inc. The descriptive data are presented as mean and standard deviation (±SD). The parametric method t – Test, Paired Comparison for Means were used for highlighting the relation and comparing the training means in different periods; for comparisons between modalities, an independent Student's t test was applied and effect size (ES) was calculated by the following equation [11]: $ES = \sqrt{\frac{t^2}{t^2+df}}$, where t is the score of t test and df are the degrees of freedom; ES was interpreted as small (ES < 0.10), medium (ES ≥ 0.10 and < 0.50) or large (ES ≥ 0.50) [17]. The effort parameters influence upon the training means in each training stage of the judokas-subjects of the study was analyzed using R, Pearson linear correlation. The values R indicate: *** – $p < 0.001$, ** – $p < 0.01$ and * – $p < 0.05$.

**Results**

The results of the biological training for competition in terms of judokas' body weight related to the weight class reveal a mean and standard deviation (±SD) weight of 89.00 ± 18.41 kg in the initial testing (IT); in the intermediate testing (I-MT) – 88.17 ± 18.24 kg; in final testing (FT) – 87.33 ± 18.08 kg, with significant differences of the averages between tests at ($t = 7.91$; $p = 0.0005$).

***Physical, Technical, and Technical-Tactical training indicators***

The results of judokas' physical, technical and technical-tactical training in terms of differences of the indicators between tests are shown in Tables 1, 2 and 3 (n = 6), pointing out the statistical indicators value: mean and ±SD, t – test Paired Comparison for means and effect size (ES).

Descriptive results of physical fitness tests are presented in Table 1. The differences of the indicators between tests show an increase of arms muscles strength (PT1 tests) in final testing (FT) by 2.17 reps (between IT and I-MT – $p > 0.05$, ES = 0.47 – medium, and between IT and FT, $p < 0.05$, ES = 0.81 – large effect); the strength of lower limbs (PFT2) has an increase at I-MT by 16.66 kg and 1.67 reps (between IT and I-MT – $p < 0.001$, ES = 0.96 (large effect) and with partner, KATA-GURUMA in FT – 11.83 reps (between IT and FT, $p < 0.001$, ES = 0.96 (large effect); the strength and mobility of the spine (PFT3) have an increase of the weight by 10 kg and 2.16 reps at FT (between IT and FT, $p < 0.05$, ES = 0.87 (large effect); the abdominal strength – torso raises with twist to the left and to the right (PFT4) has an increase by 24.34 reps at FT (between IT and FT, $p < 0.001$, ES = 0.96 – large effect).

Differences of the indicators between tests were found out in the technical training event (TTE). The descriptive results of technical training tests are presented in Table 2.

Regarding the indicators difference between tests, we notice the following values: UCHI-KOMI, rubber band in 10 sec (TTE1) shows an increase of the execution speed at the throw over shoulder in final testing (FT) by 2.67 reps (between IT and FT, $p < 0.001$, ES = 0.96 – large effect); UCHI-KOMI, with partner without throwing him in 15 sec (TTE2) has an increase of the execution speed in FT by 1.66 reps (between IT and FT, $p < 0.05$, ES = 0.80 – large effect);

**Table 1**

**Performance analysis of physical training indicators of male judo athletes (n = 6)**

| Statist. Ind. / PFT | | Mean; ±SD | | | t; p-value; ES | | |
|---|---|---|---|---|---|---|---|
| | | IT | I-MT | FT | I–I–M | I–M–F | I–F |
| PFT 1, (max. no of reps) | | 8.33; ± 2.25 | 9.00; ± 3.52 | 11.17; ± 4.26 | –1.19; 0.28; **0.47** | –5.39;0.002; *0.92* | –3.11; 0.02; *0.81* |
| PFT 2, (kg / max. no of reps) | a | 16.67; ± 4.08 | 33.33; 8.16 | | | | |
| | b | 8.50; ± 1.05 | 10.17; ± 1.33 | | –7.91; 0.001; *0.96* | –5.00; 0.004; *0.91* | –7.91; 0.001; *0.96* |
| | c | | | 11.83; ±1.72 | | | |
| PFT 3 (kg / max. no of reps) | a | 16.67: ± 4.08 | 21.67; ± 4.08 | 26,67; ± 4,08 | | | |
| | b | 6.17; ± 1.17 | 7.17; ± 1.60 | 8.33; ± 2.06 | –3.87; 0.012; *0.87* | –3.79; 0.013; *0.86* | –3.99; 0.0104; *0.87* |
| PFT 4 (max. no of reps) | | 50.83; ± 14.33 | 60.17; ± 14.86 | 75.17; ± 17.58 | –10.16; 0.0002; *0.98* | –6.66; 0.0011; *0.95* | –12.00; 0.0001; *0.98* |

**Notes: PFT** – physical fitness tests; **a** – load used in IT and I-MT; **b** – number of reps; **c –** with partner; **ES** – Effect size. Values in **bold** indicate medium effect and *italic* – large effect.

**Table 2**

**Performance analysis of technical training indicators of male judo athletes (n = 6)**

| Statist. Ind. / TTE | Mean; ±SD | | | t; p-value; ES | | |
|---|---|---|---|---|---|---|
| | IT | I-MT | FT | I-IM | IM-F | I-F |
| TTE1 – UCHI-KOMI Rubber band in 10 sec (reps) | 11.00; ± 2.00 | 12.50; ± 1.87 | 13.67; ± 2.06 | –4.39; 0.007; *0.89* | –3.79; 0.013; *0.86* | –8.00; 0.0005; *0.96* |
| TTE2 – UCHI-KOMI in 15 sec (reps) | 14.17; ± 1.72 | 15.17; ± 1.94 | 15.83; ± 2.56 | –2.74; 0.04; *0.77* | –2.00; 0.10; *0.67* | –2.99; 0.03; *0.80* |
| TTE3 – NAGE-KOMI in 30 sec (reps) | 10.33; ± 1.63 | 11.50; ± 2.26 | 13.00; ± 2.28 | –2.91; 0.03; *0.79* | –6.71; 0.0011; *0.95* | –8.00; 0.0005; *0.96* |

**Notes: TTE** – technical test events; **ES** – Effect size. Values in *italic* indicate large effect.

**Table 3**

**Performance analysis of technical and tactical training indicators of male judo athletes (n = 6)**

| Statist. Ind. / Test event | Mean; ±SD | | | t; p-value; ES | | |
|---|---|---|---|---|---|---|
| | IT | I-MT | FT | I-IM | IM-F | I-F |
| RANDORI in NE-WAZA (2 min × 3 partners, points) | 4.33; ± 0.21 | 7.17; ± 0.75 | 13.5; ± 0.55 | –17.00; 0.000; *0.99* | –37.00; 0.000; *0.99* | –55.00; 0.000; *0.99* |
| RANDORI in TACHI-WAZA (2 min × 3 partners, points) | 2.83; ± 0.98 | 5.00; ± 1.09 | 8.83; ± 0.98 | –13.,00; 0.000; *0.98* | –23.00; 0.000; *0.99* | –35.00; 0.001; *0.99* |
| SHIAI (2 min × 3 partners, points) | 2.17; ± 0.41 | 3.83; ± 0.41 | 5.83; ± 0.41 | –7.91; 0.0005; *0.96* | –11.00; 0.0001; *0.97* | –17.39; 0.000; *0.99* |

**Notes: ES** – Effect size. Values in italic indicate large effect.

NAGE-KOMI with throwing of partner, executed on the right side in 30 sec (TTE3) shows an increase of the execution speed by 2.67 reps (between IT and FT, $p < 0.001$, ES = 0.96 – large effect).

Descriptive results of the judokas' technical-tactical training are listed in Table 3.

The indicators have the following differences between tests: RANDORI in NE-WAZA with OSAE-WAZA, SHIME-WAZA and KANSETESU-WAZA for 2 minutes, with change of 3 partners, highlights the training improvement in the final test (FT) by 9.17 points (between IT and FT, $p < 0.001$, ES = 0.99 – large

**Table 4**

**Relation of the indicators of elite judokas' training components in the basic mezzocycle, initial testing (n = 6)**

| R; P | | | Bio. Trg. | | Physical training | | | | | | Technical training | | | Tech.-Ta. Trg. | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | | 5 | | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| | | | | | | a | b | a | b | | | | | | | |
| Bio. Trg. | 1 | | | .987 < .001 | –.898 < .05 | .931 < .01 | .363 | .931 < .01 | .511 | –.891 < .05 | –.853 < .05 | –.633 | –.831 < .05 | –.358 | –.358 | .019 |
| | 2 | | | | –.884 < .05 | .966 < .01 | .329 | .966 < .01 | .610 | –.843 < .05 | –.798 | –.597 | –.826 < .05 | –.275 | –.275 | .097 |
| Physical training | 3 | | | | | –.834 < .05 | –.338 | –.834 < .05 | –.405 | .975 < .001 | .889 < .05 | .759 | .889 < .05 | .573 | .573 | .000 |
| | 4 | a | | | | | .467 | 1.000 < .001 | .768 | –.763 | –.735 | –.616 | –.700 | –.316 | –.166 | .400 |
| | | b | | | | | | .467 | .571 | –.339 | –.286 | .055 | –.467 | –.738 | .485 | .701 |
| | 5 | a | | | | | | | .768 | –.763 | –.735 | –.616 | –.700 | –.316 | –.166 | .400 |
| | | b | | | | | | | | –.249 | –.171 | –.116 | –.244 | –.110 | .029 | .768 |
| | 6 | | | | | | | | | | .942 < .01 | .802 | .883 < .05 | .631 | .631 | .064 |
| Tech. Trg. | 7 | | | | | | | | | | | .909 < .01 | .919 < .01 | .581 | .581 | –.000 |
| | 8 | | | | | | | | | | | | .931 < .01 | .414 | .414 | –.293 |
| | 9 | | | | | | | | | | | | | .312 | .312 | –.353 |
| Tech.-Ta. Trg. | 10 | | | | | | | | | | | | | | –.100 < .001 | .707 |
| | 11 | | | | | | | | | | | | | | | .707 |
| | 12 | | | | | | | | | | | | | | | |

**Notes:** here and in table 5, 6 Bio. Trg. – biological training, Tech. Trg. – Technical Training; Tech.-Ta. Trg. – Technical – Tactical Training, R – Pearson linear correlation.

effect); RANDORI in TACHI-WAZA for 2 minutes, while changing 3 partners, highlights an improvement by 5.00 points in FT (between IT and FT, $p < 0.001$, ES = 0.99 – large effect); SHIAI respecting the regulatory provisions for 2 minutes, changing 3 partners – it shows a training improvement in FT by 3.00 points (between IT and FT, $p < 0.001$, ES = 0.99 – large effect).

***Correlative analysis of the relation between the indicators of judokas' training components***

The results of the correlative analysis of the indicators of judokas' training components are shown in Tables 4, 5 and 6, regarding the biological training (weight and class of weight), physical training, technical training, technical-tactical training and the level of significance of Pearson correlation.

Table 4 presents the relations of the indicators of judokas' training components during the basic mesocycle (MzC), n = 6, highlighting 91 correlations between the studied indicators, 24 significant correlations (4 at $p < 0.001$, 8 at $p < 0.01$ and 12 at $p < 0.05$) and 67 poor or even non-existent correlations.

The results of the correlative analysis between the 12 studied indicators reveal 24 significant correlations out of 91 correlations (26.37 %): the biological training (BT) shows 12 significant correlations out of 25, the physical training (PT) – 8 significant correlations out of 51, the technical training (TT) – 3 significant correlations out of 12 and the technical-tactical training (T-TaT) – 1 significant correlation out of 3.

Table 5 shows the relations of the indicators of judokas' training components in the competitive MzC 1, n = 6; there are 91 correlations between the analyzed indicators, 26 significant correlations (4 at $p < 0.001$, 9 at $p < 0.01$ and 13 at $p < 0.05$) and 65 weak or inexistent correlations.

The results of the correlative analysis between the 12 studied indicators highlight 26 significant correlations out of 91 (28.57%): the BT has 11 significant correlations out of 25, PT – 12 out of 51, TT – 3 out of 12 and T-TaT – 0.

**Table 5**

**Relation of the indicators of elite judokas' training components in the competitive mesocycle 1, Intermediate Testing (n = 6)**

| R; p | | Bio. Trg. | | Physical training | | | | | | Technical training | | | Tech.-Ta. Trg. | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | | 5 | | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| | | | | | a | b | a | b | | | | | | | |
| Bio. Trg. | 1 | | .988 < .001 | –.937 < .01 | .935 < .01 | .559 | .935 < .01 | .279 | –.825 < .05 | –.736 | –.879 < .05 | –.863 < .05 | –.357 | –.590 | –.251 |
| | 2 | | | –.906 < .05 | .966 < .01 | .557 | .966 < .01 | .362 | –.771 | –.728 | –.852 < .05 | –.807 | –.275 | –.607 | –.210 |
| Physical training | 3 | | | | –.835 < .05 | –.513 | –.835 < .05 | –.071 | .963 < .01 | .890 < .05 | .966 < .01 | .975 < .001 | .549 | .622 | .449 |
| | 4 a | | | | | .676 | 1.000 < .001 | –.616 | –.799 | –.733 | –.316 | –.045 | .000 | –.447 | .000 |
| | 4 b | | | | | | .676 | –.189 | –.401 | –.459 | –.679 | –.137 | .476 | –.137 | .476 |
| | 5 a | | | | | | | –.616 | –.799 | –.733 | –.316 | –.447 | .000 | –.447 | .000 |
| | 5 b | | | | | | | | .887 < .05 | .868 < .05 | .375 | .742 | .735 | .742 | .734 |
| | 6 | | | | | | | | | .873 < .05 | .921 < .01 | .977 < .001 | .721 | .577 | .468 |
| Tech. Trg. | 7 | | | | | | | | | | .887 < .05 | .868 < .05 | .375 | .742 | .734 |
| | 8 | | | | | | | | | | | .972 < .01 | .532 | .470 | .489 |
| | 9 | | | | | | | | | | | | .655 | .498 | .494 |
| Tech.-Ta. Trg. | 10 | | | | | | | | | | | | | .000 | .000 |
| | 11 | | | | | | | | | | | | | | .577 |
| | 12 | | | | | | | | | | | | | | |

**Notes:** Bio. Trg. – biological training, Tech. Trg. – Technical Training; Tech.-Ta. Trg. – Technical – Tactical Training, R – Pearson linear correlation.

**Table 6**

**Relation of the indicators of elite judokas' training components in the competitive mesocycle 2, Final Testing (n = 6)**

| | | Bio Trg | | Physical training | | | | | Technical training | | | Tech-TaTrg | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| | | | | | | a | b | | | | | | | |
| Bio Trg | 1 | | .989 < .001 | –.940 < .01 | .374 | .939 < .01 | –.025 | –.838 < .05 | –.790 | –.877 < .05 | –.863 < .05 | .020 | –.289 | –.478 |
| | 2 | | | –.893 < .05 | .419 | .966 < .01 | .054 | –.818 < .05 | –.738 | –.854 < .05 | –.822 < .05 | .097 | –.333 | –.478 |
| Physical training | 3 | | | | –.268 | –.824 < .05 | .219 | .923 < .01 | .939 < .01 | .945 < .01 | .967 < .01 | .129 | .247 | .594 |
| | 4 | | | | | .616 | .862 < .05 | –.118 | –.261 | –.128 | –.255 | –.530 | .335 | .237 |
| | 5 a | | | | | | 0.277 | –.743 | –.700 | –.759 | –.752 | –.000 | –.166 | -.400 |
| | 5 b | | | | | | | .351 | .257 | .343 | .255 | –.354 | .427 | .553 |
| | 6 | | | | | | | | .938 < .01 | .985 < .001 | .948 < .01 | –.114 | .418 | .841 < .05 |
| Tech Trg | 7 | | | | | | | | | .922 < .01 | .967 < .01 | .224 | .166 | .700 |
| | 8 | | | | | | | | | | .971 < .01 | –.081 | .495 | .759 |
| | 9 | | | | | | | | | | | .160 | .357 | .645 |
| Tech-Ta Trg | 10 | | | | | | | | | | | | –.557 | –.447 |
| | 11 | | | | | | | | | | | | | .415 |
| | 12 | | | | | | | | | | | | | |

In Table 6 are listed the relations of the indicators of judokas' training components in the competitive MzC 2, n = 6, revealing a number of 78 correlations between the analyzed indicators: 24 correlations are significant ones (2 at $p < 0.001$, 12 at $p < 0.01$ and 10 at $p < 0.05$) while 54 correlations are poor or non-existent.

The results of the mutual correlative analysis between the 12 indicators under study reveal 24 significant correlations out of 78 (30.77%): the BT has 11 significant correlations out of 23, PT – 10 out of 40, TT – 3 out of 12 and T-TaT – 0.

In terms of performances obtained in competition during the finals of the Individual National Championships for Seniors, the athlete B.C. won the first place (4 ippon) at 90 kg category while the athlete V.B. (100 kg category) – the third place (3 ippon); two athletes were injured; the same athlete B.C. won the second place (2 ippon) in the Individual National Championships Ne Waza.

**Discussion**

An important factor of judokas' preparation was the biological training for competition [13], especially keeping the same body weight for the competitive categories. In order to reach or to maintain the body weight required by the competition class, each judoka worked differently during the competitive period 1 and 2 in terms of parameters relation and type of the effort (velocity, strength or endurance). Some studies focus on such issues like the influence of weight loss on physical performance capacity in judokas, the need of a weight management control program, and the effect of body weight loss on stress and recovery [5, 10, 18].

The dynamics of effort parameters in each training mesocycle of the judokas-subjects of the study is shown by the temporal characteristics regarding the duration of the workouts and the content of the training means planned for each component – number of sets, reps and the rest periods between sets (Fig. 1).

The judokas' physical training (PT) used general and specific means 16.67 % in the basic and competitive 1 MzC and 12.63% in the competitive 2 MzC (circuit strength workouts; UCHI-KOMI with elastic band, SEOI-NAGE with partner without throwing him; TANDOKU-RENSHU and NAGE-KOMI with partner's throw during workouts with opponents and evaluation through fitness tests depending on the periods and the MzC of training).

The results of the tests highlight the increase of arms muscles strength, the progressive increase of lower limbs muscles strength (KATA – GURUMA with load and partner), increase of neck and back strength (head bridge executed with load and partner) and increase of abdominal muscles strength. In order to improve the body effort capacity and the various motor skills, the effort volume and intensity were gradually increased by: growth of effort volume in each training session, higher density of the exercises during the workout, increase of the number of training sessions (per week or per day). In this respect, there are studies dealing with topics like the fitness level of competitive male judo players [14], the determination of judo endurance performance using the UCHI-KOMI technique and an adapted lactate minimum test [6], the effect

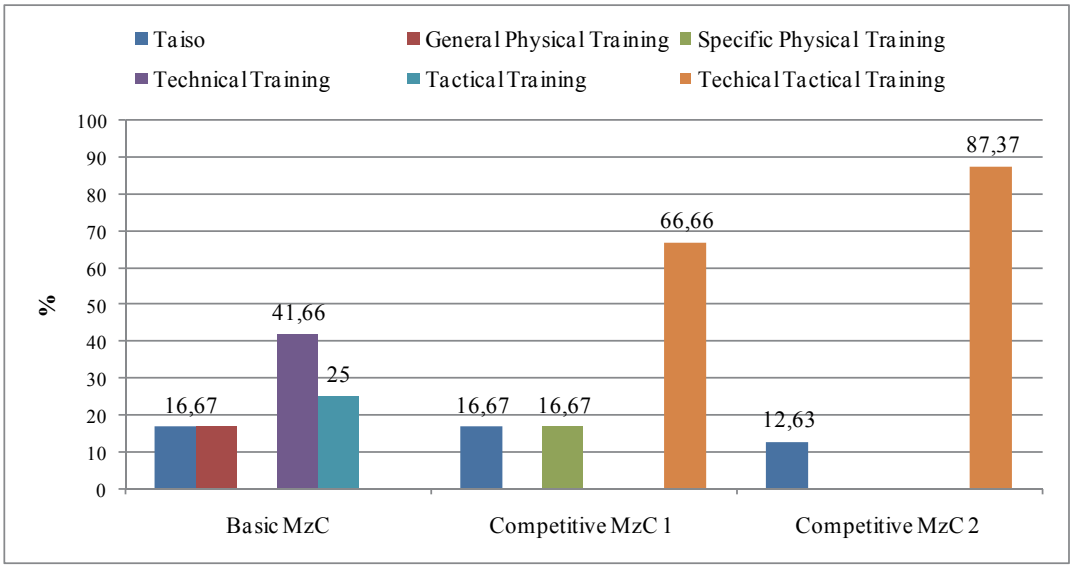


**Fig. 1. Content of the training means in elite judokas' preparation**

of the coordinated motor abilities on performance in judokas [30], the development of force and force-velocity abilities of judokas [31].

The technical training (TT) of judokas highlights the use 16.67% of the UCHI-KOMI and NAGE-KOMI techniques, combinations between the preferred techniques using RENRAKU-WAZA throughout the basic training period (MzC) and the competitive period 1. The specialized literature analyzed the time spent addressing and performing different types of gripping by athletes in all male weight classes in world judo matches [7], the sequences of errors in the Judo throw Morote Seoi Nage and their relationship to the learning process [21], the basic technical skills (throws) in 17–19-year-old judokas [25], the difference in gripping configurations during the execution of throwing techniques between male and female cadets [26], the teaching-learning process of judo techniques improved using the knowledge of errors, the Tai-Otoshi technique as a case study [28], the rotational acceleration during head impact resulting from different judo throwing techniques [35], the structure of throws technique in different age groups in men judo [46].

The tactical training (TaT) was made in the basic MzC using the combinations (41.66%) RANDORI NAGE-WAZA changing the partner with a partner of different size.

The technical-tactical training (T-TaT) was made in the competitive MzC 1 using the techniques or combinations (66.66%) – BUTSUKARI-GEIKO, the repetition of combinations with partner in movement and changing the partner – YAKU-SOKU-GEIKO, free fight with imposed theme, changing the partner – RANDORI and almost-like competition fight – SHIAI. The competitive MzC 2 used the techniques (87.37%): standing fight with different size partner – RANDORI NAGE-WAZA, fight on the floor changing the partner with a partner of different size – RANDORI NE-WAZA and competition-like combat, respecting the regulation provisions (referees) – SHIAI. Some studies deal with the efficiency of judokas' technical-tactical training for competitions [1, 8, 33], the importance of movement symmetry in technical-tactical preparation of highly advanced judokas [49].

As for the relation of the indicators studied during each MzC of judokas' training, we notice the influence of effort parameters upon the significance level of the correlation at $p < 0.001$, $p < 0.01$ and $p < 0.05$ between body weight and competitive category, the physical, technical and technical-tactical test events, in conformity with the performances achieved in competitions. The specialized literature focuses on the relationship between changes in total-body water and fluid distribution with maximal forearm strength in elite judo athletes [48]. There are also studies focusing on the effect of interval training in the competitive period [36, 38]; the differences in the technical-tactical and time-motion patterns between modalities, performance-related variables are different in Judo and BJJ [11].

**Conclusions**

In summary, an optimal relation between the effort parameters and the training components contributed to an increased performance capacity. The optimization of the general physical training and the consolidation of the preferred techniques combined with other techniques improved the judokas' technical-tactical training. The proper dosage of effort indicators in the workouts led to the improvement of sports performances, techniques and technical-tactical combinations and to the increase of the specific effort capacity of the body. The optimal specific effort capacity (maintained by improving the technical and tactical training in real conditions of combat with partners of different size) ensured the training maximum level and the performance capacity increase.

Therefore, we can conclude that our study succeeded to approach two important aspects regarding the relation and differences of fitness tests indicators in judokas and the relation of the indicators of performance judokas' training components. We can also confirm that the influence of effort parameters on the components of judokas' training helped to increase the muscle strength necessary for the technical execution of the assimilated improved techniques, as shown by the significant differences and relations between tests and by the performances achieved in competitions.

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# ПЛАНИРОВАНИЕ ПАРАМЕТРОВ УСИЛИЯ В ТРЕНИРОВОЧНОМ ЦИКЛЕ ДЗЮДОИСТОВ ВЫСОКОГО КЛАССА

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**Цель:** оценить влияние параметров усилия на показатели тестов физической подготовленности у дзюдоистов в зависимости от тренировочных компонентов. **Материалы и методы.** Использование тренировочных методов осуществлялось в следующем режиме с учетом общей направленности тренировок: подходы и повторы (адаптация), повторы с постепенным увеличением нагрузки (оптимальное состояние), соревновательный режим (двигательные стереотипы). Авторами была разработана экспериментальная методика с использованием специальных тренировочных средств. В эксперименте приняли участие 6 спортсменов, тренировавшихся под наблюдением в течение 3 мезоциклов: базового, а также первого (1) и второго (2) соревновательного мезоциклов. Тесты физической подготовленности оценивали биологическое состояние спортсменов и их физические, технические и технико-тактические показатели. Эксперимент также предусматривал оценку выступлений спортсменов на двух национальных соревнованиях. Параметрические тесты

проводились с уровнем значимости $p \leq 0,05$. **Результаты.** Результаты исследования подтверждают достижение требуемой эффективности тренировок в каждом тренировочном мезоцикле, а также улучшение биологических, физических (16,67 % в базовом и соревновательном (1) мезоциклах, 12,63 % – в соревновательном (2) мезоцикле), технических (41,66 % в базовом мезоцикле), тактических (25 % в базовом мезоцикле) и технико-тактических показателей дзюдоистов (66,66 % в соревновательном (1) мезоцикле, 87,37 % в соревновательном (2) мезоцикле). Результаты корреляционного анализа между 12 изученными показателями выявили 24 значимые корреляции из 91 в базовом мезоцикле (26,37 %), 26 значимых корреляций из 91 в соревновательном (1) (28,57 %) и 24 значимые корреляции из 78 в соревновательном (2) мезоциклах (30,77 %). **Заключение.** Полученные результаты демонстрируют, что контроль параметров усилия способствует совершенствованию подготовки дзюдоистов и повышает эффективность их тренировок.

***Ключевые слова:*** *единоборства, тесты физической подготовленности, планирование, компоненты тренировки, статистический анализ.*

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