# DIFFERENTIATION BETWEEN HIGH CLASS JUDOISTS IN TERMS OF INDICES OF EXPERIENCE, PHYSICAL DEVELOPMENT, PSYCHOMOTOR FITNESS AND THEIR ACTIVITIES DURING COMPETITIONS

**by**

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The aim of the present work was to give an answer to the question whether such factors as weight category, age and training career, advancement degree and the actual level of successes in the sport are related to physical fitness tests.

A research was carried out on 16 competitors during their immediate preparations just before the Polish Judo Seniors' Championship in Chorzów in May in 1998. The average values of age, training career, body mass and height and of the Rohrer body build index (R.I.) were as follows: 22. 8 aged 11. 9 years, 81.19 kg, 175. 9 cm, with RI averaging 1.48. Their degree of advancement ranged from 2 Kyu to 3 Dan.

The following tests were used in our research on the competitors' state of preparation: Measurement of reaction with choice, cross apparatus, a labyrinth i. e. a device examining the remembering function and learning by the trial-and-error method, Special Judo Fitness Test (SJFT) some observations of the course of fights during Polish Championships.

Calculations helped to ascertain that the awarding of points during the Polish Championships depended both on the characteristics obtained during laboratory research, on parameters measured by means of SJFT, and on individual indexes describing the course of fight.

It was discovered, that the competitors attaining the best results in this sport during the period preceding the Polish Championships had considerably better psycho-motor fitness and higher ability to concentrate on their tasks than the judoists with poorer results. The observation and analysis of the course of fights verified the need for conducting both laboratory research and the special fitness motor test. It can be concluded that the methods employed can be successfully used to monitor judoists'

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psycho-physical state and to evaluate the level of their special fitness preparation during their participation in competitions.

**Key words:** judo, motor abilities, special fitness,

*Introduction*

Division into weight categories in combat sports aims at balancing the strength capability of competitors. In this situation, they try to overcome their opponents mostly by better use of technical as well as tactical skills and employment of their potential developed during their special physical fitness preparation, the essential basis of which is their motor co-ordination. Rivalry in sports demands from competitors both quick and precise reactions to changing situations (Żukowski 1995). When judoists' bouts get longer, then their physical motor abilities become more important. From a wide review of literature it follows that apart from technical and tactical (Sikorski 1985, Kęsek and Sterkowicz 1991 et. al), fitness preparation (Lehman and Müller-Deck 1987, Sikorski 1985, Sterkowicz 1996), mental preparation is also very important for their successes in judo (Gracz et al. 1984,Kłodecka-Różalska 1983, Zak 1978, Żukowski 1974, Żyto-Sitkiewicz 1986).

The basic objective of the present work is to give an answer to the question whether such factors as weight category, age, training career, degree of proficiency, and the current level of their successes in this sport are related essential differentiation among the tested judoists in terms of their results in fitness tests.

*Material and Methods*

During the preparations, immediately preceding the Polish Judo Seniors' Championships in Chorzów, held between the 29th and 31st of May in 1998, a complex research was conducted on 16 competitors of TS Wisła-Code in Cracow. The average values (including their range) of age, training career, body mass and height, and the Rohrer index (R.I.) were as follows respectively: 22.8 (18 - 32) of year, 11.9 (7 - 20) of year, 81.19 (58 -120) kg, 175.9 (163 – 192) cm, with R.I. equaled to 1.48 (1.08 - 1.79). Their degrees of proficiency

ranging from 2 Kyu to 3 Dan, was marked as follows 2 Kyu = 1; 1 Kyu = 2; 1 Dan = 3; 2 Dan = 4 and 3 Dan = 5.

In our research on the state of preparation of the competitors the following tests were used:

1) psychometric tools (two weeks before the championships – on May the 16th 1998)

2) special judo fitness test (SJFT) (on May the 20th 1998)

3) observation of the course of fights during the Polish Judo Seniors' Championships in Chorzów held between the 29th and 31st of May in 1998.

In point 1, the material was gathered by means of:

a) the apparatus measuring reaction choice time (ZAK – Determinationsgerät DTG 3, device made in Germany), which permits to determine psychomotor fitness under the circumstances that require the subject to choose both a stimulus and the kind of reaction to it itself. The results are also the basis for determining the fitness of the nervous system during work under strain. This device gives a possibility to define the style of attention characteristic for a particular person. It also serves to study complex reactions and visual-motor co-ordination.

In the course of our research the device gives stimuli, the competitor reacts by pressing a button corresponding in colour to the stimulus being shown on the control desk or by pressing one of the two pedals used for measuring reaction. The device offers a possibility for a wide range of programming of the speed of stimuli and their kind. The subject can work at the rate imposed by the device or at his or her own speed. We took account of the number of correct reactions in their individual rate out of many parameters measured for the analysis in our research

b) the cross-shaped device (K-5 by ELEKTROMET, Poland) tests motor-visual co-ordination on the basis of spatial orientation, perception, concentration, attention, its variability, and resistance to fatigue of the nervous system. It also permits to measure general psychomotor efficiency.

The tests were programmed at a pre-set rate of 50 stimuli per minute. The number of correct reactions determined the result. In the pre-set rate we estimated the time necessary for the subject to execute the programmed tasks and the number of incorrect reactions; the speed of appearing of stimuli was

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conditioned by the speed of correct answers by the subject. Each program consisted of 49 stimuli. The order of the light signals (in vertical and horizontal arrangement) was programmed in advance. The purpose of the tested subject was to press the button imposed by the co-ordinates of the stimuli on the control desk.

c) the labyrinth (made by Defoure in France) is a device to examine the function of learning by trial-and-error method on the basis of perceiving spatial elements. The results obtained permit to plot a curve of learning. The subject had 10 trials. In the first trial, by means of try-and-error method, the task was to find the hidden way that a beam of light travels through the labyrinth and to remember it. In the consecutive tests, it was necessary to lead the beam of light through the labyrinth with the least number of errors, till the desired result was achieved. The following variables were included in our analysis: the number of necessary repetitions to memorize the track, number of movements in every trial, time of work in every attempt, and style of work of the subject (on the ground of observation).

2. The special judo fitness test (SJFT) - worked out at the Combat Sports Department at the Academy of Physical Education in Cracow by Sterkowicz (1995, 1996) was conducted in a training gym. It ran as follows: two judoists (Uke) from the same weight category and of about similar body height would occupy their positions 6 m from each other while the subject (Tori) stood between them. At the command "Hajime", "Tori" would run to one of "Uke", execute an "Ippon-seoi-nage" throw, and then he would attack the other "Uke" judoist (fig. 1).

The repetition of those throws lasted 15 seconds (Series A), and then at the command "Matte", there followed a 10-second rest period. Series B and C were also separated by a pause amounting to 10 seconds. The throws executed in series A, B, and C were calculated immediately after the SJFT test was over.

3. Recording and analysis of fight effectiveness. During the Polish Championships '98 some fifty-one fights were video-recorded and analyzed in terms of their time and matter structures in order to calculate the following indices:

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Fig. 1. The decisive phase of the throw „Ippon-seoi-nage" (according to Iwai et. al. 1977)

$$\text{Activities in attack AA} = \frac{\text{Total number of attacks}}{\text{Time of fight}} \qquad (1)$$

$$\text{Effectiveness in attack EA} = \frac{\text{Number of successful attacks}}{\text{Total number of attacks}} \qquad (2)$$

$$\text{Activities in defence AD} = \frac{\text{Number of the opponent's attacks}}{\text{Time of fight}} \qquad (3)$$

$$\text{Effectiveness in defence ED} = \frac{\text{Number of successful actions in defence}}{\text{Total number of successful actions in defence}} \qquad (4)$$

Statgraphics Plus 4.1 programme was used for a statistical analysis of the gathered data. After verifying normality of distribution of particular variables, average values and measures of distribution were calculated. On the basis of the number of victorious and lost bouts fought during the Polish Judo Seniors' Championships, 16 competitors were selected according to the level of their successes in judo. The participants of the tournament were divided into three groups. Group One (n = 6) was formed by those with the highest successes, who occupied from the 3$^{rd}$ to the 5$^{th}$ places (we awarded 5,5 and 3,5 points

respectively), Group Two (n = 5) were those who won 0.75 - 1.50 points (points awarded for the fights won), and Group Three (n = 5) comprised those participants in the tournament, who did not win a single fight (they were awarded 0.25 points).

ANOVA test and the Duncan multiple range tests verified the importance of differences between averages determined the influence of each factor on successes in judo. When forming those groups, we took into account the median criterion and the categories were determined according to:

1) age (younger – M $\leq$ Me; older – S $>$ Me),
2) body mass (lighter – L $\leq$ Me; heavier C $>$ of Me),
3) training career (shorter – K $\leq$ Me; longer –D $>$ Me),
4) degree of proficiency (lower – N, i.e. from 2 Kyu – 1 Kyu; average – Ś, i.e. 1 Dan; higher – W, i.e. 2 – 3 Dan.

Owing to the small size of the groups of the competitors and in the case of unequal variance, medians (Me) were additionally compared, whereas the hypothesis about their equality was verified by a non-parametric ANOVA method with the Kruskal-Wallis ranks. Then we calculated the values of correlation coefficients of the Spearman "rsp" of independent variables in relation to competitors' successes in judo during the Polish Championships '98.

*Results*

**a) General characteristics of the judo competitors.**

The general characteristics of the 16 tested judoists' data are listed according to their weight category in table 1. No essential differences were found in terms of age, training career, degree of proficiency. The basic indices of physical development naturally singled out the lighter (L) from the heavier category (C), and at the same time the Rohrer index (R.I.) showed that the athletic type prevailed in weight class L while the picnic one in class C. Bearing in mind this fact in our further analysis of the material, it seemed proper to accept the level of their successes in judo as of the principle criterion in the interpretation of the results gathered in this research.

Table 1. Statistics (mean, S.D. and median) describing judo seniors with regard to their weight category (n = 16)

| | Variables | Statistics | Lighter Category – L (n = 8) | Heavier Category – C (n = 8) |
|---|---|---|---|---|
| 1. | Age (years) | $\bar{x}$ | 23.9 | 21.7 |
| | | Me | 21.0 | 21.0 |
| | | S.D. | 4.97 | 2.60 |
| 2. | Training career (years) | $\bar{x}$ | 12.6 | 11.3 |
| | | Me | 11.5 | 10.5 |
| | | S.D. | 4.34 | 1.58 |
| 3. | Degree of proficiency | $\bar{x}$ | 3.12 | 2.25 |
| | | Me | 3.0 | 2.5 |
| | | S.D. | 1.12 | 1.16 |
| 3. | Body height (cm) | $\bar{x}$ | 171.7 | 180.1 |
| | | Me | 172.5 | 181.0 |
| | | S.D. | 6.54 | 7.64 |
| 4. | Body Mass (kg) | $\bar{x}$ | 69.3 | 93.1 |
| | | Me | 69.5 | 89.0 |
| | | S.D. | 8.17 | 11.87 |
| 5. | Rohrer Index | $\bar{x}$ | 1.37 | 1.59 |
| | | Me | 1.39 | 1.57 |
| | | S.D. | 0.139 | 0.148 |

It was ascertained that Group Three, which in respect of body mass was similar to Group One dominated considerably over Group Two (the Kruskal-Wallis test 7.13; $p < 0.05$), and did not show any significant differences in terms of body height and the Rohrer index values.

The competitors from Group One were the oldest and the difference in relation to Group Three was statistically significant. Some analogous differences occurred in the case of their training career. The level of their successes in the tournament was connected with the degree of proficiency (Kruskal-Wallis test 7.02; $p < 0.05$). The mutual arrangement of average group values is the case for the importance of the competitors' experience for their effectiveness in the competitions (table 2).

Table 2. Characteristics of judo competitors with different levels of successes in judo

| | Group | 1 | 2 | 3 | Total |
|---|---|---|---|---|---|
| Factors | N | 6 | 5 | 5 | 16 |
| Age (years) | $\bar{x}$<br>Me<br>S.D. | 25.3<br>24.5<br>4.41 | 22.6<br>21.0<br>3.78 | 20.0<br>20.0<br>1.22 | 22.8<br>21.0<br>3.99 |
| Training career (years) | $\bar{x}$<br>Me<br>S.D. | 14.0<br>12.5<br>3.41 | 11.2<br>10.0<br>3.70 | 10.2<br>10.0<br>0.45 | 11.93<br>11.0<br>3.23 |
| Degree of proficiency | $\bar{x}$<br>Me<br>S.D. | 3.5<br>3.0<br>0.84 | 2.8<br>3.0<br>1.09 | 1.6<br>1.0<br>0.89 | 2.7<br>3.0<br>1.20 |
| Body height (cm) | $\bar{x}$<br>Me<br>S.D. | 178.3<br>178.5<br>9.52 | 171.2<br>170.0<br>5.76 | 177.8<br>181.0<br>7.73 | 175.9<br>176.0<br>8.12 |
| Body mass (kg) | $\bar{x}$<br>Me<br>S.D. | 84.3<br>80.5<br>19.56 | 68.4<br>69.0<br>10.11 | 90.2<br>88.0<br>5.67 | 81.2<br>82.5<br>15.78 |
| R.I. Index | $\bar{x}$<br>Me<br>S.D. | 1.47<br>1.49<br>0.148 | 1.36<br>1.42<br>0.163 | 1.61<br>1.61<br>0.171 | 1.48<br>1.47<br>0.182 |

Remark: group 1 = highest competitive results; group 2 = intermediate competitive results; group 3 = lowest competitive results

## c) Differentiation of the psycho-motor predispositions of the competitors in terms of the level of their sports successes, age, training career, degree of proficiency, and the basic indices of physical development.

Out of several of parameters recorded by the apparatus to measure reaction with choice, a number of correct answers at their individual speed were chosen for the analysis. It testifies to their internal mobilization to execute their motor assignments. The average values showed similarities between the representatives of Groups One, Two, and Three rather than differences in this respect. The greatest differentiation of the results was found in Group Two (table 3). On the basis of the results obtained, it was also ascertained that the factors of age, training career, degree of proficiency, physical development indices of the judoists did not tally with the results on this device.

Table 3. Number of correct reaction at their individual speed – time of test 1 minute
(measurement of alternative reactions)

| Correct Reaction at their individual speed | Group | 1 | 2 | 3 | Total |
|---|---|---|---|---|---|
| | N | 6 | 5 | 5 | 16 |
| | $\overline{x}$<br>Me<br>S.D. | 72.0<br>71.5<br>4.56 | 65.0<br>71.0<br>11.0 | 71.6<br>74.0<br>5.77 | 69.69<br>72.0<br>7.67 |

Remark: group 1 = highest competitive results; group 2 = intermediate competitive
results; group 3 = lowest competitive results


Table 4. Parameter values of visual and motor co-ordination and spatial orientation (test
on cross-shaped device)

| Parameters measured on cross-shaped device | Group | 1 | 2 | 3 | Total |
|---|---|---|---|---|---|
| | N | 6 | 5 | 5 | 16 |
| Pre-set rate of 50 stimuli per minute | $\overline{x}$<br>Me<br>S.D. | 40.0<br>43.0<br>9.27 | 33.8<br>32.0<br>12.32 | 30.2<br>25.0<br>12.70 | 35.0<br>35.5<br>11.41 |
| Enforced tempo – time of reaction | $\overline{x}$<br>Me<br>S.D. | 49.8<br>47.0<br>10.80 | 53.4<br>55.0<br>12.12 | 53.0<br>57.0<br>11.20 | 51.9<br>51.5<br>10.69 |
| Enforced tempo- Errors (n) | $\overline{x}$<br>Me<br>S.D. | 4.8<br>5.5<br>3.31 | 1.2<br>1.0<br>1.30 | 1.4<br>1.0<br>0.55 | 2.6<br>2.0<br>2.70 |

Remark: group 1 = highest competitive results; group 2 = intermediate competitive
results; group 3 = lowest competitive results


A positive increase in the results of groups 2 and 1 in comparison with
Group Three during the test on this cross-shaped device was related with the
level of successes of the participants during the Polish Championships. In terms
of the reaction time received by the device at the pre-set rate (i.e. 50 stimuli per
minute) Group One – of the highest level of the points scored during the
tournament was characterized also by the shortest time used to execute
programmed tasks at an enforced tempo. In this to group, however, the number
incorrect answers were greater than in Groups Two and Three. The described
differences, although express essential discrepancy between speed and accuracy

in solving co-orditionally complicated tasks, were not statistically significant (p > 0.05). They testify to the competitors' strong motivation to execute their assignments best (table 4).

Then, analysing the importance of experience factor (age, sports career, degree of proficiency) it was shown that the younger persons had significant worse results ($\bar{x} = 30.0$) on the cross-shaped device than older ones ($\bar{x} = 43.3$) in terms of reaction received at a pre-set rate of 50 stimuli per minute (F = 7.25; p < 0.05). A similar dependence was also ascertained in the case of sports career (F = 5.98; p < 0.05), where in group K the average result amounted to 29.67 reactions, while in group D – 41.86 reactions.

The degree of proficiency in judo, which is connected with sports career, significantly differentiated the competitors in the number of recorded reactions at the enforced tempo (F = 6.21; p < 0.05), showing superiority of those highly advanced ($\bar{x} = 47.3$ reactions) over the less advanced ones ($\bar{x} = 36.5$ reactions) and the average judoists ($\bar{x} = 25.2$ reactions). With the Duncan test, the difference between teams W and Ś was not statistically significant. The younger judoists also needed more time ($\bar{x} = 56.1$ s) to solve their assignments at the enforced tempo on the cross-shaped device (F = 5.16; p < 0. 05) than the older ones ($\bar{x} = 45.0$ s). During this test we did not find big differences in the number of errors made by team M ($\bar{x} = 2.2$) in comparison with S ($\bar{x} = 3.3$). Additionally, it was shown that the degree of proficiency of the judoists contributed to the shortening of the time used to solve assignments at the enforced tempo. Yet, in the case of the highly advanced judoists significant shorter time was recorded ($\bar{x} = 40.7$ s) than in the less advanced competitors ($\bar{x} = 58.6$ s). This index did not single out group Ś in comparison with team W, nor team N (Duncan test).

16 subjects were tested during the initial (P0) and the first labyrinth trial (P1). In trial P1, the number of indispensable movements to execute the assignment ($\bar{x} = 22.8$) was reduced to 15.2 movements, 67% of those recorded in P0. As shown in fig. 2, during the second trial (P2) the task was executed by 14 competitors, while during the sixth trial (P6) half of the entire group managed to cover the optimum course successfully in 10 movements.
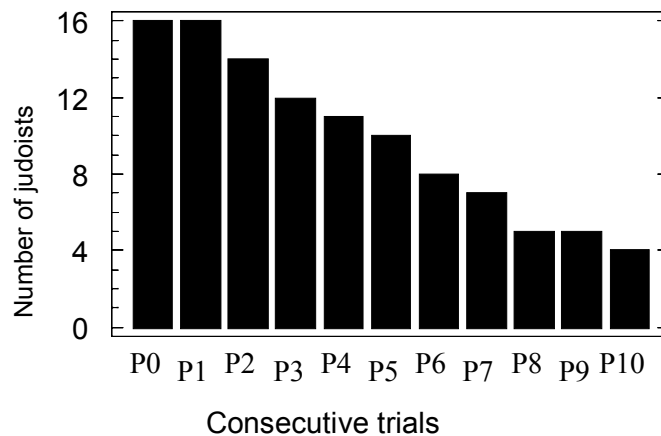
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Fig. 2. Number of of judo competitors who succeed in consecutive trials of labyrinth test

The level of successes in judo differentiated the results of the research on this device. While only one the of the competitors from Group One executed the assignment faultlessly in the labyrinth as early as in the second trial P2, and another four judoists in the next trial - third one, it was only in the fourth and fifth trials that successful attempts were recorded in Groups Two and Three. Only the competitors from Groups Two and Three, who had worse results in the tournament, participated in trials 9 and 10.

Taking into account the number of movements in the labyrinth P0 essential differentiation to the advantage of Group One was recorded in comparison with Group Two ($F = 4.83$; $p < 0.05$). Moreover, in the first labyrinth trial P1 there occurred a more distinct separation of the average group results ($F = 5.95$; $p < 0.05$). In light of the Duncan multiple range test those differences boiled down to the substantial superiority of Group One over groups Two and Three (tab 5).

Table 5. Results of judo competitors in labyrinth trial

| Trials in labyrinth | Group | 1 | 2 | 3 | Total |
|---|---|---|---|---|---|
| | N | 6 | 5 | 5 | 16 |
| Labyrinth P0 | $\overline{x}$ | 18.8 | 26.4 | 24.0 | 22.81 |
| | Me | 19.0 | 30.0 | 25.0 | 22.0 |
| | S.D. | 2.93 | 6.07 | 2.92 | 5.10 |
| Labyrinth P1 | $\overline{x}$ | 12.0 | 17.4 | 17.0 | 15.2 |
| | Me | 12.0 | 16.0 | 15.0 | 15.0 |
| | S.D. | 1.90 | 3.43 | 3.39 | 3.77 |

Remark: group 1 = highest competitive results; group 2 = intermediate competitive results; group 3 = lowest competitive results

Furthermore, it was shown that the factor of sports career influenced the manner of going through the labyrinth, because the subjects with less experience from group K had to execute more movements ($\overline{x}$ = 17.2) than the competitors from group D ($\overline{x}$ = 12.7 movements).

c) **Differences in the judoists' special motor fitness with regard to their level of successes in judo, as well as their age, training career, degree of proficiency, and the basic indices of physical development.**

The average results of SJFT test characterising the state of special fitness preparations during immediate preparations for participation in the competitions showed significant differences between Groups One, Two, and Three (table 6).

The number of throws in series A (15 s) was the greatest among the judoists with the highest successes in the tournament, average – in the case of those with average level and, the smallest – in the weakest ones (Group Three). In the next series B (30 s) there also appeared differences between Group One and Tree. In series C (30 s) significant between-group differences had already been shown (ANOVA F = 4.81; p < 0.05). The average number of throws in team 1 was substantially higher than in Group Three. This phenomenon was then confirmed in relation to the total of throws from the three SJFT series (Duncan test). The plot shows the mean of each of the all the three groups. Also shown is the grand mean and the 95% decision limits. The samples, which fall outside the decision limits, are significantly different from the grand mean of series C of SJFT (Fig. 3).

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Table 6. Number of throws in special motor fitness test by competitors with different level of success in judo

| Consecutive series of throws | Group | 1 | 2 | 3 | Total |
|---|---|---|---|---|---|
| | N | 6 | 5 | 5 | 16 |
| Series A (15 s) | $\overline{x}$ <br> Me <br> S.D. | 7.0 <br> 7.0 <br> 0.00 | 6.6 <br> 7.0 <br> 0.89 | 6.2 <br> 6.0 <br> 0.84 | 6.6 <br> 7.0 <br> 0.72 |
| Series B (30 s) | $\overline{x}$ <br> Me <br> S.D. | 11.5 <br> 11.5 <br> 0.55 | 11.2 <br> 12.0 <br> 1.30 | 10.2 <br> 10.0 <br> 0.84 | 11.0 <br> 11.0 <br> 1.03 |
| Series C (30 s) | $\overline{x}$ <br> Me <br> S.D. | 11.2 <br> 11.0 <br> 0.75 | 10.4 <br> 11.0 <br> 0.89 | 9.8 <br> 10.0 <br> 0.45 | 10.5 <br> 10.5 <br> 0.89 |
| SJFT Sum of throws | $\overline{x}$ <br> Me <br> S.D. | 29.7 <br> 29.5 <br> 1.21 | 28.2 <br> 30.0 <br> 3.03 | 26.2 <br> 26.0 <br> 2.05 | 28.1 <br> 28.5 <br> 2.50 |

Remark: group 1 = highest competitive results; group 2 = intermediate competitive results; group 3 = lowest competitive results
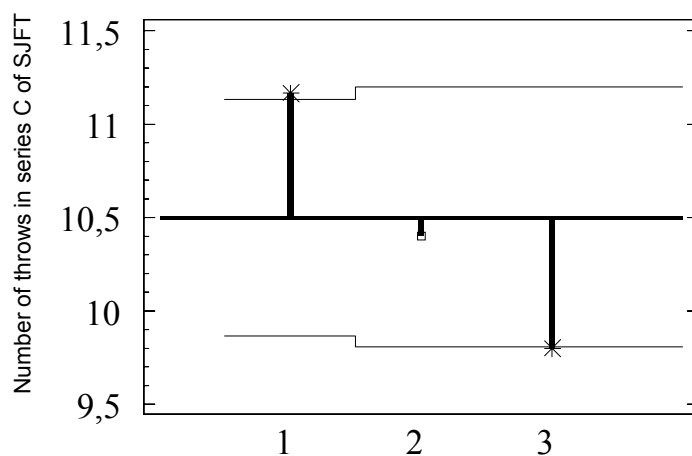


Group of competitors according to level of their achievement during the All Polish Judo Championships '98

Fig. 3. Number of throws in series C of SJFT executed by competitors who have different level of achievements on the background of the average values of whole grooup (10.5)

**d) Indices characterizing the activity of the competitors during their participation in the competitions.**

During the competitions, Group One had 25 fights, Group Two 17 fights and Group Three only 5 fights. The indices characterizing the course of fight of the competitors with different sportive level were listed in table 7.

Table 7. Indices characterising course of fights conducted by competitors with different levels of successes in competitions

| Indices of Course Fight | Group | 1 | 2 | 3 | Total |
|---|---|---|---|---|---|
| | N | 6 | 5 | 5 | 16 |
| Activity in Attack(AA) | $\overline{x}$ | 0.67 | 0.66 | 0.10 | 0.49 |
| | Me | 0.65 | 0.63 | 0.00 | 0.51 |
| | S.D. | 0.227 | 0.280 | 0.224 | 0.356 |
| Efficiency in Attack(EA) | $\overline{x}$ | 0.63 | 0.58 | 0.54 | 0.59 |
| | Me | 0.66 | 0.50 | 0.50 | 0.58 |
| | S.D. | 0.188 | 0.266 | 0.313 | 0.241 |
| Activity in Defence (AD) | $\overline{x}$ | 0.49 | 0.78 | 1.24 | 0.81 |
| | Me | 0.42 | 0.53 | 1.24 | 0.66 |
| | S.D. | 0.18 | 0.62 | 0.35 | 0.500 |
| Efficiency in Defence (ED) | $\overline{x}$ | 0.64 | 0.53 | 0.10 | 0.44 |
| | Me | 0.66 | 0.55 | 0.00 | 0.50 |
| | S.D. | 0.137 | 0.126 | 0.224 | 0.284 |

Remark: group 1 = highest competitive results; group 2 = intermediate competitive results; group 3 = lowest competitive results

The values of average indices of activity and efficiency in attack clearly divided the competitors with different level of successes at the Polish Championships '98 (for AA index value ANOVA F = 9.53; $p < 0.01$, and for EA index value F = 15.44; $p < 0.001$). The representatives of Group One and Two were significantly superior over Group Three.

Furthermore, importance of the experience factor was confirmed, for the competitors with less experience i.e. the younger were less efficient in attack the older ones (F = 5.38; $p < 0.05$), than those with longer sports career (F = 5.88; $p < 0.05$), and those with greater degree of proficiency (F = 9.71; $p < 0.01$). EA index in the age groups amounted on average to in younger M = 0.32 against older S = 0.62; according to sports career in shorter K = 0.30 against

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longer D = 0.60. According to the degree of proficiency in lower level (N) were found smaller values (0.12) than in average level (Ś = 0. 57) and the group of higher level of advancement  W = 0.59.

Undoubtedly, their training career and degree of proficiency influenced the judoists' activity in attack and defence. The value of AA index was considerably lower in group K ( $\bar{x}$ = 0.34) than in Ś ( $\bar{x}$ = 0.70) with F = 5.10; p < 0.05. The increased role of activity in attack was also observed in the groups with higher degree of mastery (F = 4.18; p < 0.05). Group N was distinguished by essentially lower value of AA index ( $\bar{x}$ = 0.12 of attacks per minute of fight) in comparison with group Ś ( $\bar{x}$ = 0.66) and W ( $\bar{x}$ = 0.57). In this respect, there also occurred a clear distinction between those groups in weight categories (F = 14.30; p < 0.01; for L = 0.74 > C = 0.25).

Analyzing the influence of their age, it was shown that in the case of AD index, activity in the defence, there appeared double superiority of group M (1 per minute) over team S (0.49 actions per minute). The degree of proficiency also discriminated group N ( $\bar{x}$ = 1.19 actions per minute) in comparison with team Ś ( $\bar{x}$ = 0.70) and especially group W ( $\bar{x}$ = 0.48). A little lower values in class C ( $\bar{x}$ = 0.63) than L (0.99) were calculated in weight categories. The significant differences in median values were confirmed by the Kruskall-Wallis test (6.73; p < 0. 01).

Less noticeable differences, yet of opposite direction, also occurred in terms of ED defence efficiency index.

**e) Some correlation of the awarded points during the competitions with the results of psychomotor and special fitness tests, and the activities during participation in the competitions.**

The variance analysis of the studied variables indicated their influence on ranking in the competitions; therefore final confirmation was sought by calculating the correlation of the Spearman ranks. As a result of those calculations, it was ascertained that the awarding of points during the Polish Championships depended both on characterizations obtained in the laboratory tests, on parameters measured during the SJFT test, and on individual indices of the course of fight.

The number of reactions received by the cross-shaped device at the pre-set rate and the ranking were on average correlated (rsp = 0. 48), while the number of indispensable movements to go through of the labyrinth in the first two trials showed high correlation with the awarding of points (rsp P0 = -0.54; rsp P1 = -0.64).

The total of throws during the SJFT test considerably influenced the successes in the competitions (rsp = 0. 63). In the consecutive stages of SJFT, the value of correlation coefficient increased, amounting to 0.47 in series A, 0.51 in series B, 0.64 in series C.

The characteristics of the course of fight correlated highly with the success of competitors in the tournament, and especially with the efficiency in attack index (rsp = 0. 73) and activities in defence (rsp = -0. 67). The correlation of the index of activity in attack and of awarding of points in the competitions was not much weaker (rsp = 0. 66). No such dependency (rsp = 0. 08) was ascertained in the case of efficiency in defence.

The findings of Salvadora et al. (1999) gave support to the view that testosterone can be linked to the expression of competitive aggression. A positive relation between testosterone and offensive behaviors was obtained in the sense that the greater the hormonal titer, the greater the number of threads, fights, and attacks. These findings coincide with the relationships found using observational scales.

*Recapitulation*

The aim of the present work was an attempt at diagnosing the state of special preparation for championship competition. On the basis of the research results the following information was obtained:

1. Competitors attaining the best results in this sport during the period preceding the Polish Championships were characterized by considerably better psychomotor efficiency and to mobilize for their assignments than the judoists with weaker results.
2. The observation and analysis of the course of fights verified of rightness of conducting laboratory tests and special motor-fitness tests.

It can be concluded that the methods employed by us can be successfully applied to monitor the state of psychophysical disposition and to evaluate the level of judoists' special fitness preparations for their participation in competitions.

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