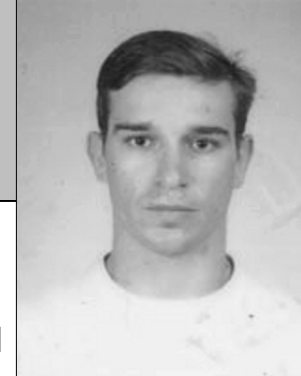




TECHNIQUES USED BY JUDOISTS DURING THE WORLD AND OLYMPIC TOURNAMENTS 1995–1999

SPOSÓB WALKI ZAWODNIKÓW DZUDO PODCZAS MISTRZOSTW
ŚWIATA I IGRZYSK OLIMPIJSKICH W LATACH 1995–1999

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Słowa kluczowe: džudo, technika, taktyka, mistrzostwa świata, igrzyska olimpijskie

Key words: judo, technique, tactics, World Championships, Olympics

Abstract: This study investigated the characteristics of high level judo athletes in the most important international competition considering the type of technique applied according to the traditional judo classification system and the time when they were applied, taking in consideration the category of the athletes (lighter and heavier categories). The main results of the statistical analysis of the 4,813 actions were: (1) a predominance of *Ashi-waza* in both categories; (2) the best part of scores were obtained during the first three minutes of fight; (3) penalties accounted for almost half of the scores obtained; (4) we found a temporal trend in pattern of action scores, which was stronger in heavyweight categories. Percentage of *Ippon*, *Waza-ari* and *Yuko* decreased, whereas *Hansokumake/Keikoku* and *Shido* had a tendency to increase in the consecutive tournaments 1995–1999; (5) some techniques that could not be classified according to the traditional system appeared in 1997.

Those findings can be useful for the organization and management of the big sports events, and choosing by the coaching staff the proper training tasks for the athletes too.

Introduction

The characterization of high-level judo athletes can help to enhance their training according to the effectiveness of techniques. This analysis is also important for high-level judo athletes to improve their strategies against specific characteristics of the most important opponents.

Studies about technical and tactical aspects of judo explored which techniques were applied in specific tournaments [1, 2, 5, 8, 9, 11]. Weers [13], for example, reported that Olympic and World Champions used, on average, 6 techniques in *Tachi-waza* (throwing techniques) and 2 in *Ne-waza* (groundwork techniques). Thus, despite the fact that judo consists of almost one hundred techniques, athletes seem to specialize in very few. Another study [12] was carried out to assess on number and evaluate the characteristics of attacks considering the traditional judo classification system. But, no previous study has investigated consecutive high level competitions (World Championships and Olympic Games) considering the type of techniques which resulted in a score, the time when they were applied and the weight category of the competitor.

Thus, this study aimed at investigating the profile of high-level judo athletes competing in the most important international competitions. We compared the characteristics of high-level competitors considering type of technique applied according to traditional judo classification system and time when applied taking in consideration the category of athletes (lighter and heavier categories).

Material and methods

All fights in all weight categories during the World Championships (1995, 1997 and 1999) and of the Atlanta Olympic Games (1996) were analyzed. All the data was the

official results of the International Judo Federation. Categories ($n = 7$) were divided into two groups: (A) lighter – below 78 kg or 81 kg (for the 1999 World Championship); (B) heavier – above 78 kg or 81 kg (for the 1999 World Championship). The data from the open category was not considered for our analysis because this category was not included in the Olympic Games. The techniques were grouped according to the traditional judo classification in the following categories: *Te-waza* – hand techniques of throwing in a standing position, *Koshi-waza* – loin techniques of throwing in a standing position, *Ashi-waza* – foot and leg techniques of throwing in a standing position, *Sutemi-waza* – throwing in the lying position, *Osaekomi-waza* – holdings, *Kansetsu-waza* – bending and twisting the joints, and *Shime-waza* – the art of strangling. When a technique could not be classified according to the traditional judo it was grouped as “other”.

Statistical analysis – mean, median and standard deviation were computed for the temporal characteristics of fights. Comparisons of distribution of techniques were made through Chi-Square independence tests. The significance level was established at 5% ($p < 0.05$). We used the contingency coefficient C as a measure of degree of association between the rows and columns.

Results and discussion

Standard time of the actions scored in the judo fights

The men's judo fights lasted till 5th minute of effective time (without breaks, but competitors tried to finish them before time). Figures 1 and 2 show a tendency to decrease the number of fights, which still lasted in the 5th minute, particularly in the heavyweight category. But the distribution of number of fights that continued in the successive minutes did not

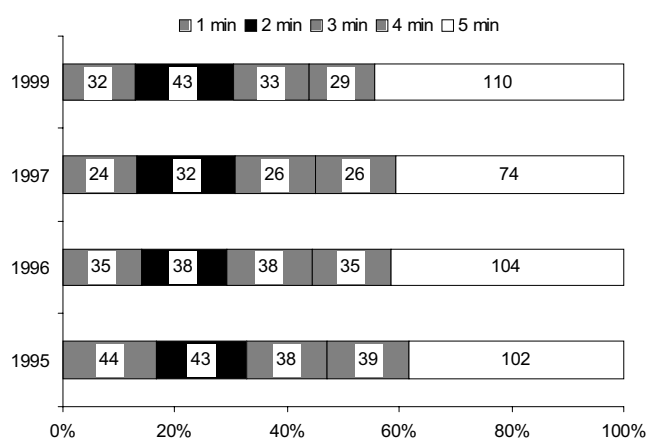


Fig. 1. Number and percentages of fights finished in consecutive minutes by competitors of lightweight categories by year of tournament

Ryc. 1. Liczba i procent walk turniejowych zakończonych w kolejnych minutach przez zawodników wag lekkich w latach 1995–1999

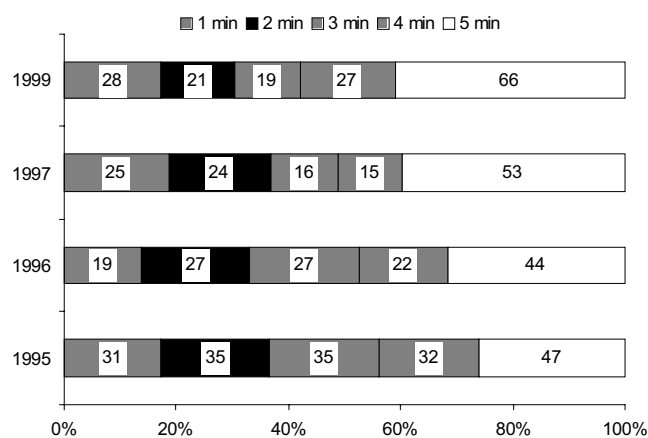


Fig. 2. Number and percentages of fights finished in consecutive minutes by competitors of heavyweight categories by year of tournament

Ryc. 2. Liczba i procent walk turniejowych zakończonych w kolejnych minutach przez zawodników wag ciężkich w latach 1995–1999

depend statistically on the year of the competition in both the lightweight and the heavyweight categories (Chi-square test $p > 0.05$).

The comparisons with the reference data show that across fourteen years during Polish Championships the intensity of bouts were increased. The following changes were noticed: serious shortening of the effective time of a fight; decreasing of the time of fight in *Tachi-waza* in comparison with the time of the whole fight; and shortening breaks during the fight [11].

We analyzed 1,558 fights, in which 4,813 actions were scored by competitors in the most prestigious judo tournaments between 1995 and 1999. We ignored the data concerning the matches in the open category of World Championships 1995, 1997 and 1999, because they were not scheduled in the Olympic Tournament 1996.

Table 1 shows the summary statistics of typical course of fight time, in which competitors scored both from technical actions (throws and grappling techniques) and from penalties of their opponents.

In the first minute of judo fight the standard time when competitors scored ranged between 22.7 and 50.7 s (with an

average \pm SD = 36.7 ± 14.0 sec). In the second minute of bout the typical time, on average, amounted to 89.6 sec, in the third minute the average was 149.3 sec, in the four minute it was 209.2 sec, and in the last minute the time of scored actions was 271.8 sec. The majority of scored actions occurred in first and second minute of fight (24.4% and 26.9). Many of them were finishing actions (*Ippon*). So in the third, fourth and fifth minutes, we noticed a decrease in the number of the actions scored (20.9%, 15.0% and 12.7% respectively). Those findings were confirmed by the results of the earlier analysis of time distribution of the number of points received in judo matches at senior level [12].

Turning to our research, we assumed that the analysis of the frequency of each technique type and penalties could help to identify the most frequently occurring type of decisive actions. As for the graphical representation we used the Fishbone Diagram, which displays cause-and-effect relations. Figure 3 shows the name of the effect (*Ippon-gachi*) and the primary (*Ashi-waza*, *Te-waza*, *Sutemi-waza*), secondary (*Osaekomi-waza* and *Koshi-waza*), and tertiary causes leading to success (*Kansetsu-waza*, *Shime-waza* and penalties).

Figure 4 revealed typical time, when the penalties and/or technical actions were scored. The actions that forced the opponent to penalty reactions had strong influence on the course of the judo bouts. This tactics occurred in about 47% of the total number of scored actions. The time characteristics of those 2,248 penalties were (on average) 90th sec for *Shido*, 156th sec for *Chui*, 198th sec for *Keikoku* and 205th sec for *Hansokumake* decisions.

In Polish Championships during 92 matches video recorded only *Shido* and *Chui* penalties were given. Relatively high number of those penalties during the first two minutes of match was result of low activity (non-combativity) as the athletes try to figure out their opponent. The high number of penal-

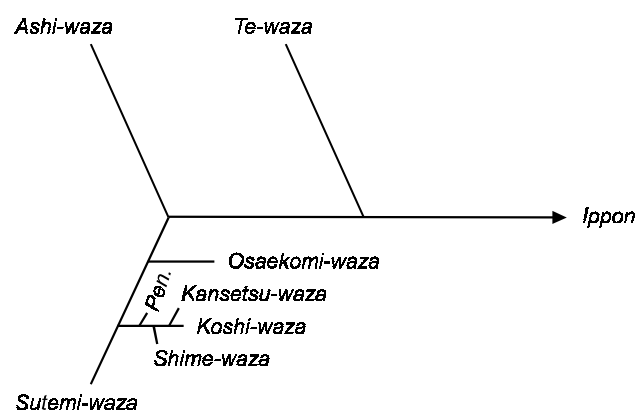


Fig. 3. Techniques terminating the fight before time limit
Remark: *Koshi-waza* – loin techniques of throwing in a standing position, *Ashi-waza* – foot and leg techniques of throwing in a standing position, *Te-waza* – hand techniques of throwing in a standing position, *Sutemi-waza* – throwing in the lying position, *Osaekomi-waza* – holdings, *Kansetsu-waza* – bending and twisting the joints, *Shime-waza* – the art of strangling /choking; Pen. – penalties

Ryc. 3. Techniki wpływające na przyznanie zwycięstwa przed czasem. Uwaga: *Koshi-waza* – techniki biodrowe w stojce, *Ashi-waza* – techniki nożne w stojce, *Te-waza* – techniki ręczne w stojce, *Sutemi-waza* – rzuty połączone z upadkiem atakującego zawodnika, *Osaekomi-waza* – trzymanie w parterze, *Kansetsu-waza* – dźwignie na stawy, *Shime-waza* – duszenia; Pen. – kary

Tab. 1. Scores of competitors by time in judo fight
Tab. 1. Punktacja działań zawodników podczas walki dżudo

Consecutive minutes/Kolejne minuty	1	2	3	4	5	Total /Ogółem
Scores (n)/Punktowane akcje	1,173	1,297	1,006	724	613	4,813
Average (sec)/Średnia [s]	36,7	89,6	149,3	209,2	271,8	130,6
Median (sec)/Mediana [s]	37,0	89,0	149,0	207,5	272,0	118,0
Standard Deviation (sec) /Odchylenie standardowe [s]	14,0	17,2	17,7	17,7	17,2	80,4

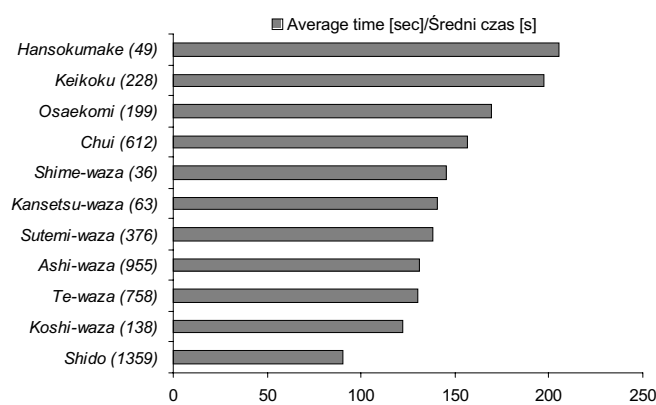


Fig. 4. Number and standard time of actions scored by judo competitors

Ryc. 4. Liczba i typowy czas akcji punktowanych w walce dżudo

ties in the last minute is probably caused by many simulated attacks, fatigue, and passive defense by athletes trying to maintain advantages score [12].

The gradual character of penalties incurred owing to combat avoidance (non-combativity), was responsible for their occurrence in the consecutive minutes of fight. Between the penalties appeared scores for techniques performed with efficacy of *Koka*, *Yuko*, *Waza-ari* and *Ippon* levels. Of course they appeared in all the time of the fights, but on, average, effective techniques occurred in the third minute. Typical time for *Koshi-waza* was, on average, 122nd sec, for *Te-waza* – 130th sec, and for *Ashi-waza* – 131st sec, for *Sutemi-waza* – 138th sec. And then there followed *Katame-waza*, i.e., *Kansetsu-waza* in the standard time of 140th sec, *Shime-waza* in the 145th sec, and *Osaekomi-waza* in 170th sec. Due to the values of the standard deviations, which were about 80 sec for the techniques enumerated above, we can state that competitors effectively used 3/4 (75%) of the technical actions in the period from the first minute to end of the third minute of fight.

The comparison of data in figure 4 seems to have verified the hypothesis about the change in the proportions of the techniques which were used in the three periods of fights. The frequency of popular throws *Te-waza* and rare used *Koshi-waza* and grappling techniques of *Kansetsu-waza* and *Shime-waza* were seldom, especially in the case of longer fights (see fights lasted in fifth minute – almost entire time). The techniques mentioned above were more effective in the first period of bout (first two minutes). *Ashi-waza* techniques were most frequently used in all three periods of fight, which comprised 40.7% of all the techniques used in longest fights. Similar changes in time were characteristic of *Sutemi-waza*.

Table 2 displays counts for an 8 by 3 table. The first number in each cell of the table is the count or frequency. The second number shows the percentage of the column table represented by that cell. For example, there were 200 values in the first row and the first column. This represents 7.7% of the 2,586 values in the table. But for the aim of our analysis we calculated column percentage. The Chi-Square test performed a hypothesis to determine whether or not to reject the idea that the techniques used and the time of fight classifications were independent. Since the P-value was less than 0.01, we can reject the hypothesis that rows and columns were independent at the 99% confidence level. Therefore, the observed row for a particular case was related to its column. The contingency coefficient showed the measure of degree of association between the rows and columns. This coefficient was standardized for its possible maximum, which depended on the numbers of the rows and columns. In this case Cmax was 0.876.

From the coaching point of view, the time distribution of number of attacks during the Polish Championships was also analyzed. Most attacks were performed in the third minute of the match but their effectiveness in that minute was low. This was probably caused by the increasing fatigue of the athletes. This was confirmed by the analysis of the temporal structure of judo matches. A significantly increased level of activity in the last minute of the match testified to the athlete's determination as they were trying to change the outcome of match [12].

Differences between categories concerning the time of fight and the percentage of scores

Table 3 shows that in both the lighter weight and heavier weight categories we observe a decrease in fights finished in the fifth minute during consecutive tournaments. In the heavyweight categories the difference obtained from the comparison between 1995 and 1999 was 14.9%, whereas in the lightweight categories this difference was 6.2%. Simultaneously, statistical analyses showed that these patterns within each category were highly consistent during the four tournaments. When we analyzed time of effective fight without breaks in Polish Championships, we found the index of using the maximal time of a fight, i.e. 5 min in 1996 was 58.3% whereas in 1983 was 87.3% [11].

Furthermore, we analyzed all 4,813 scores registered during the four most important events between 1995 and 1999. Table 4 summarizes the comparisons made between the distribution of eight scores in the subset of lightweight and heavyweight categories. We found significant difference between them.

Tab. 2. Changes in the techniques used in the judo fights
 Tab. 2. Zmiany technik stosowanych w walce džudo

Techniques/Techniki	First 2 min /Pierwsze 2 min	Second 2 min /Następne 2 min	Last min (5 th) /Ostatnia min (5)	Row Total/Ogółem
<i>Te-waza</i>	200 30.53%	226 27.80%	332 29.70%	758 29.31%
<i>Koshi-waza</i>	46 7.02%	43 5.29%	49 4.38%	138 5.34%
<i>Ashi-waza</i>	213 32.52%	287 35.30%	455 40.70%	955 36.93%
<i>Sutemi-waza</i>	84 12.82%	112 13.78%	180 16.10%	376 14.54%
<i>Osaekomi-waza</i>	49 7.48%	93 11.44%	57 5.10%	199 7.70%
<i>Kansetsu-waza</i>	30 4.58%	25 3.08%	9 0.81%	64 2.47%
<i>Shime-waza</i>	18 2.75%	11 1.35%	7 0.63%	36 1.39%
<i>Other</i>	15 2.29%	16 1.97%	29 2.59%	60 2.32%
Column Total/Ogółem	655 25.33%	813 31.44%	1,118 43.23%	2,586 100.00%

Chi-Square (chi-kwadrat) = 82.61; Df = 14; P-Value (P) = 0.0000;
 Contingency Coeff. (współczynnik zbieżności cech) = 0.201

Tab. 3. Counts and percentages of fights finished in consecutive minutes 1–5 during judo tournaments between 1995 and 1999
 (MH – male heavier categories, ML – male lighter categories)

Tab. 3. Liczba i procent walk zakończonych w kolejnych 1–5 minutach podczas turniejów rozegranych w latach 1995–1999
 (MH – cięższe kategorie mężczyzn, ML – lżejsze kategorie mężczyzn)

	1 min	2 min	3 min	4 min	5 min	Row Total /Ogółem
1995 MH	28 17.39%	21 13.04%	19 11.80%	27 16.77%	66 40.99%	161 100%
1996 MH	25 18.80%	24 18.05%	16 12.03%	15 11.28%	53 39.85%	133 100%
1997 MH	19 13.67%	27 19.42%	27 19.42%	22 15.83%	44 31.65%	139 100%
1999 MH	31 17.22%	35 19.44%	35 19.44%	32 17.78%	47 26.11%	180 100%
1995 ML	32 12.96%	43 17.41%	33 13.36%	29 11.74%	110 44.53%	247 100%
1996 ML	24 13.19%	32 17.58%	26 14.29%	26 14.29%	74 40.66%	182 100%
1997 ML	35 14.00%	38 15.20%	38 15.20%	35 14.00%	104 41.60%	250 100%
1999 ML	44 16.54%	43 16.17%	38 14.29%	39 14.66%	102 38.35%	266 100%
Column Total /Ogółem	238 15.28%	263 16.88%	232 14.89%	225 14.44%	600 38.51%	1,558 100%

Chi-Square (chi-kwadrat) = 30.97; Df = 28; P-Value (P) = 0.3184

Tab. 4. Frequency of scores obtained by competitors of lighter and heavier weight categories (ML – male lighter categories, MH – male heavier categories)

Tab. 4. Częstość punktów otrzymywanych przez zawodników lżejszych i cięższych kategorii wagowych (ML – lżejsze kategorie mężczyzn, MH – cięższe kategorie mężczyzn)

Scores /Punktacja	ML	MH	Row Total /Ogółem
<i>Koka</i>	301 10.54%	125 6.38%	426 8.85%
<i>Yuko</i>	511 17.90%	258 13.18%	769 15.98%
<i>Waza-ari</i>	318 11.14%	145 7.41%	463 9.62%
<i>Ippon</i>	539 18.88%	368 18.79%	907 18.84%
<i>Hansokumake</i>	16 0.56%	33 1.69%	49 1.02%
<i>Keikoku</i>	93 3.26%	135 6.89%	228 4.74%
<i>Chui</i>	300 10.51%	312 15.93%	612 12.72%
<i>Shido</i>	777 27.22%	582 29.72%	1,359 28.24%
Column Total /Ogółem	2,855 59.32%	1,958 40.68%	4,813 100.00%

Chi-Square (chi-kwadrat) = 132.10; Df = 7; P-Value (P) = 0.0000; Contingency Coeff. (współczynnik zbieżności) = 0.198

For practical reasons, we interpreted the percentages in the column. The frequency of *Ippon*-scores were very similar in both categories of elite judo competitors, whereas lighter categories had advantage in the percentages of technical scores *Waza-ari*, *Yuko* and *Koka* over the heavier weight categories. A reverse situation was characteristic of the frequency of penalties, in which the heavier categories dominated over the lighter ones.

Changes in the same category over the years

There were 2,855 actions scored by lightweight competitors. The Chi-Square test did not prove any statistical dependency over the years and the frequency of scores in the consecutive tournaments (we rather find homogeneity judoists' effectiveness in fight in this respect). The action of competitors in the lightweight categories were frequently evaluated as *Shido* (penalty – 3 pts), *Ippon* (winning technique 10 pts) and *Yuko* (7 pts) – see table 5.

We did the same analysis for heavier categories data and we found a temporal trend in the pattern of action scores. The percentage of *Ippon*, *Waza-ari* and *Yuko* decreased, whereas *Hansokumake/Keikoku* and *Shido* had a tendency to increase in the consecutive tournaments 1995–1999 (see table 6).

Predominance of type of technique used in the lighter and heavier categories in judo tournaments 1995–1999

In table 7 we can observe differences verified by the Chi-square test statistics and contingency coefficient C. *Ashi-*

-waza dominated in both data sets characterized the lighter and the heavier categories. The distribution of techniques depended on the category of weight.

Overall 955 of 2,585 technical actions (36.96%) were throws classified as *Ashi-waza*. But the difference between frequency (percentage) of *Te-waza* and *Ashi-waza* were very small in the light categories (1%) in comparison with heavy-weight categories (20%). These results suggest that competitors of heavyweight categories have tendency to use more *Ashi-waza* than the lightweight categories. In the both categories followed *Sutemi-waza*, *Osaekomi-waza*, and *Koshi-waza*, *Kansetsu-waza* and the unclassified technical actions with the same tendency shown in the heavier categories. In addition *Shime-waza* in the heavier categories was more rarely used than in the lightweight categories.

Change in athletes (category) *Tokui-waza* from one year to another

In table 8 we compared schooling tendencies in the lighter categories between 1995–1999.

Both main subgroups of techniques, i.e. *Te-waza* and *Ashi-waza* revealed a tendency to increase in their frequency through the years. This tendency was stronger in the *Te-waza*, and in consequence, in the World Championship '99 they started to dominate over the percent of *Ashi-waza*. The opposite directions of relative numbers of *Koshi-waza* were observed. This dependence was not so conspicuous in the percent of *Osekomi-waza*, *Kansetsu-waza* and *Shime-waza*. An important point is a rise (in 1997) in the case of the techniques that couldn't be classified according to the traditional judo classification system.

In table 9 we can observe an increase in the frequency (column percentages) of *Koshi-waza* in the consecutive tournaments. The percentage of *Sutemi-waza* dropped down slightly and especially the percentage of *Osaekomi-waza* was on the decrease after World Championships '95. This trend prevailed in the World Championships '99. In *Kansetsu* and *Shime-waza* we noticed the similar direction of changes, because the other unclassified techniques replaced them during the World Championships '97 and World Championships '99.

To verify the hypothesis concerning dependency between the rows and columns we formatted a new table, in which the expected frequencies were more than 5 (because of Chi-Square test assumptions we have to exclude *Shime-waza* category). The differences in the distribution of data sets between 1995–1999 were statistically significant. An important point was an increase (in 1997) of the techniques that could not be classified according to the traditional judo classification system.

Strong marked changes in the pattern of *Tachi-waza* were found in the comparative study of the schooling tendencies during All Polish Championships 1983 and 1996. Since 1983 evident changes have been seen in the classification of technique frequencies [12]. The main characteristics of the contemporary Polish pattern were very similar to these findings concerned four most important judo tournaments. A similar phenomenon characterized the course of fight recorded during All Polish Championships '96, in which attempts of attacks and scored attacks were filmed and counted. Unclassified techniques were particularly effective. There were techniques that did not belong to the traditional *Go-kyo* classification system. Despite the low overall frequency of attempts, each resulted in points. Undoubtedly this was related to the lack of

Tab. 5. Frequency of scores obtained in the lighter weight categories (ML) in consecutive judo tournaments 1995–1999. Remark: Since some cells in the table have frequency of less than 5, we combined *Hansokumake* and *Keikoku* categories for Chi-Square test requirements
 Tab. 5. Częstość punktów zdobywanych w lżejszych kategoriach wagowych (ML) w kolejnych turniejach dżudo 1995–1999. Uwaga: ponieważ kilka komórek w tabeli ma liczebność mniejszą niż 5, połączono klasy *Hansokumake* i *Keikoku*, żeby spełnić wymagania testu chi-kwadrat

Scores/Punktacja	ML 1995	ML 1996	ML 1997	ML 1999	Row Total/Ogółem
<i>Koka</i>	73 10.27%	69 12.75%	78 10.33%	81 9.55%	301 10.54%
<i>Yuko</i>	126 17.72%	82 15.16%	149 19.74%	154 18.16%	511 17.90%
<i>Waza-ari</i>	98 13.78%	39 7.21%	82 10.86%	99 11.67%	318 11.14%
<i>Ippon</i>	129 18.14%	114 21.07%	137 18.15%	159 18.75%	539 18.88%
<i>Hansokumake</i>	2 0.28%	1 0.18%	5 0.66%	8 0.94%	16 0.56%
<i>Keikoku</i>	24 3.38%	17 3.14%	27 3.58%	25 2.95%	93 3.26%
<i>Chui</i>	66 9.28%	63 11.65%	77 10.20%	94 11.08%	300 10.51%
<i>Shido</i>	193 27.14%	156 28.84%	200 26.49%	228 26.89%	777 27.22%
Column Total /Ogółem	711 24.90%	541 18.95%	755 26.44%	848 29.70%	2,855 100%

Chi-Square (chi-kwadrat) = 24.64; Df = 18; P-Value (P) = 0.1353

Tab. 6. Frequency of scores obtained in the men heavier weight categories (MH) in consecutive judo tournaments 1995–1999. Remark: Since some cells in the table have expected frequency of less than 5, we combined *Hansokumake* and *Keikoku* categories for Chi-Square test assumption
 Tab. 6. Częstość punktów zdobywanych w cięższych kategoriach wagowych (MH) w kolejnych turniejach dżudo 1995–1999. Uwaga: ponieważ kilka komórek w tabeli ma liczebność mniejszą niż 5, połączono klasy *Hansokumake* i *Keikoku*, aby spełnić wymagania testu chi-kwadrat

Scores/Punktacja	MH 1995	MH 1996	MH 1997	MH 1999	Row Total/Ogółem
<i>Koka</i>	35 7.59%	28 6.71%	23 5.09%	39 6.21%	125 6.38%
<i>Yuko</i>	72 15.62%	57 13.67%	62 13.72%	67 10.67%	258 13.18%
<i>Waza-ari</i>	49 10.63%	36 8.63%	26 5.75%	34 5.41%	145 7.41%
<i>Ippon</i>	93 20.17%	72 17.27%	89 19.69%	114 18.15%	368 18.79%
<i>Hansokumake</i>	3 0.65%	6 1.44%	9 1.99%	15 2.39%	33 1.69%
<i>Keikoku</i>	23 4.99%	25 6.00%	27 5.97%	60 9.55%	135 6.89%
<i>Chui</i>	55 11.93%	71 17.03%	78 17.26%	108 17.20%	312 15.93%
<i>Shido</i>	131 28.42%	122 29.26%	138 30.53%	191 30.41%	582 29.72%
Column Total /Ogółem	461 23.54%	417 21.30%	452 23.08%	628 32.07%	1,958 100%

Chi-Square (chi-kwadrat) = 41.60; Df = 18; P-Value (P) = 0.0013; Contingency Coeff. (współczynnik zbieżności) = 0.161

Tab. 7. Frequency of techniques used by competitors of lighter and heavier weight categories (ML – male lighter categories, MH – male heavier categories)

Tab. 7. Częstość technik stosowanych przez zawodników lżejszych i cięższych kategorii wagowych (ML – lżejsze kategorie mężczyzn, MH – cięższe kategorie mężczyzn)

Techniques /Techniki	ML	MH	Row Total /Ogółem
<i>Te-waza</i>	575 34.35%	183 20.09%	758 29.32
<i>Ashi-waza</i>	590 35.24%	365 40.07%	955 36.94%
<i>Koshi-waza</i>	74 4.42%	64 7.03%	138 5.34%
<i>Sutemi-waza</i>	231 13.80%	145 15.92%	376 14.55%
<i>Osaekomi-waza</i>	119 7.11%	80 8.78%	199 7.70%
<i>Kansetsu-waza</i>	37 2.21%	26 2.85%	63 2.44%
<i>Shime-waza</i>	30 1.79%	6 0.66%	36 1.39%
Other	18 1.08%	42 4.61%	60 2.32%
Column Total /Ogółem	1,674 64.76%	911 35.24%	2,585 100.00%

Chi-Square (chi-kwadrat) = 94.30; Df = 7; P-Value (P) = 0.0000; Contingency Coeff. (współczynnik zbieżności) = 0.269

developed counter measures against unorthodox moves [12]. During the All Japan Championships, despite large variability in the attempts of attacks from different subgroups of techniques, the number of decisive techniques were very rare and homogenate in their frequency. Overall 36 of 1,075 techniques classified as *Ashi-waza* (3.35%) were effective (scored). But it was stated too, that those who executed more techniques were the winners. This indicated that the aggressiveness of the winner was important. But we have to keep in mind possibility of *Kaeshi-waza* (throwing counter techniques), too. It should be stressed that defense and attack were of equal importance. Undoubtedly, analytical studies on the judo matches can help to improve judo technique and facilitate the teaching of judo [6]. Video tape recording gives more details for the analytical studies of defense than the official data.

Studies on temporal structure of judo combat – Castarlenas & Planas [3] – with 144 matches of the World Championship (1991) and the Olympic Games (Barcelona '92), that of Monteiro [7] with the Junior European Championship, Sikorski et al. [8] with the Matsumae Cup and Polish Championship and Sterkowicz & Maślej [11] with the Polish Championship – demonstrated that the sequences of combat lasted duration of 15 to 30 seconds with intervals up to 10 seconds. The main results of these studies are summarized in table 10.

In the study of Castarlenas & Planas [3], it was observed that, in general, judo matches presented 11 sequences of work (8 in *Tachi-waza* and 3 in *Ne-waza*) and 7 sequences of pause. More precisely the fight has this configuration: *Tachi-*

-waza ⇒ pause ⇒ *Tachi-waza* ⇒ *Ne-waza* ⇒ pause ⇒ *Tachi-waza* ⇒ pause ⇒ *Tachi-waza* ⇒ pause ⇒ *Tachi-waza* ⇒ *Ne-waza* ⇒ pause ⇒ *Tachi-waza* ⇒ pause ⇒ *Tachi-waza* ⇒ *Ne-waza* ⇒ pause ⇒ *Tachi-waza*. The mean time (± standard deviation) of fights was 2 min 52 sec ± 1 min 28 sec, with 2 min 0.5 sec ± 1 min 10 sec in *Tachi-waza* and 54 sec ± 38 sec in *Ne-waza*. The mean time of pauses was 1 min 41 sec ± 1 min 9 sec. The mean time of a *Tachi-waza* sequence was 17 sec, in *Ne-waza* it was 18 sec and pause was 12 sec [3].

During the Atlanta Olympic Games, Sterkowicz [9] observed that the time of combat for male group had a mean of 3 min 6 sec (62.0% of the total time) and 2 min 54 sec for the female group (72.5% of total time). Sterkowicz & Maślej [11] analyzing the Senior Polish Championship of 1996, observed results similar to that reported by Castarlenas & Planas [3]: (a) mean real time of combat (2 min 55 sec ± 1 min 50 sec); it was 58% of the total possible time (5 min); (b) mean time of *Tachi-waza* was 2 min 11 sec ± 1 min 28 sec; (c) *Ne-waza* mean time was 43 sec ± 42 sec; (d) mean time of pauses was 1 min 1 sec ± 59 sec. *Tachi-waza* sequence has 19 sec, *Ne-waza* 16 sec and interval was 10 sec. In percent, 56% of the total time was spent in *Tachi-waza*, 26% in intervals and 18% was spent in *Ne-waza*.

This new method, which included tactical thinking that leads to victory in judo fight, tested by Sterkowicz & Kozioł [10] verified the hypothetical algorithm of dynamics and tactics in effective fight. The examinations of fights recorded on videotapes were conducted together with judoists, which led to conclusions that certain actions were of particular importance. The time of the tactical steps in the winning fights were: (a) making the reconnaissance of stronger and weaker points of the opponent – 21% of total fight time for winners versus 7.4% of total time for losers; (b) concealing one's real intention – 16.1% versus 1.4%, adequately; (c) cutting down to the minimum the opponent's activity in attack and eliminating his possibilities in defense – 20% of overall fight time for winners versus 44% in losers (d) conducting real attack techniques that give scores – 31% in winners group and 25.5% in losers group; (e) keeping predominance, repeating effective actions and finishing the fight. As we can see this five-step logical algorithm had different temporal realization in the winning and losing fights. Performing the attack led to hampering the opponent's activity, but at the same time, it was essential for the final results of the given fight to conceal our judoist's intentions. Thanks to the applied analytical method for this competition activity it was possible to define individual tactics as well as trends for training programs for top-class judoists.

Final remarks – conclusion

- (1) A predominance of *Ashi-waza* in both weight categories, indicating that an efficient system of counterattack for this techniques should be part of the high level judo athletes training to avoid a score for the opponent;
- (2) Hip techniques were very rare;
- (3) The best part of scores were obtained before the 3rd minute of fight, so the athlete had to try to obtain an advantage in this period;
- (4) Penalties counted for almost half of the scores obtained, indicating that an aggressive stance is necessary in order to avoid punishment;
- (5) In 1997 some techniques occurred that could not be classified according to the traditional system, indicating that

Tab. 8. Frequency of techniques used in the men judo tournaments 1995–1999 in the lighter group (column variables: ML 95 – lighter categories in 1995, ML 96 – lighter categories in 1996, ML 97 – lighter categories in 1997, ML 99 – lighter categories in 1999)

Tab. 8. Częstość technik stosowanych w turniejach dżudo mężczyzn grupy lżejszej w latach 1995–1999 (zmienne w kolumnach: ML 95 – lżejsze kategorie w 1995 r., ML 96 – lżejsze kategorie w 1996 r., ML 97 – lżejsze kategorie w 1997 r., ML 99 – lżejsze kategorie w 1999 r.)

Techniques /Techniki	ML 95	ML 96	ML 97	ML 99	Row Total/Ogółem
<i>Te-waza</i>	136 31.85%	98 31.92%	157 35.12%	184 37.32%	575 34.35%
<i>Ashi-waza</i>	139 32.55%	109 35.50%	162 36.24%	180 36.51%	590 35.24%
<i>Koshi-waza</i>	22 5.15%	18 5.86%	15 3.36%	19 3.85%	74 4.42%
<i>Sutemi-waza</i>	54 12.65%	53 17.26%	59 13.20%	65 13.18%	231 13.80%
<i>Osaekomi-waza</i>	47 11.01%	13 4.23%	30 6.71%	29 5.88%	119 7.11%
<i>Kansetsu-waza</i>	12 2.81%	13 4.23%	5 1.12%	7 1.42%	37 2.21%
<i>Shime-waza</i>	17 3.98%	3 0.98%	8 1.79%	2 0.41%	30 1.79%
Other/Inne	0 0.00%	0 0.00%	11 2.46%	7 1.42%	18 1.08%
Column Total /Ogółem	427 25.51%	307 18.34%	447 26.70%	493 29.45%	1,674 100.00%

Chi-Square (chi-kwadrat) = 52.05; Df = 18; P-Value (P) = 0.0000; Contingency Coeff. (współczynnik zbieżności) = 0.195

Tab. 9. Frequency of techniques used in the heavier categories at judo men tournaments in 1995–1999. (Column variables: MH 95 – heavier categories in 1995, MH 96 – heavier categories in 1996, MH 97 – heavier categories in 1997, MH 99 – heavier categories in 1999)

Tab. 9. Częstość technik stosowanych w turniejach dżudo mężczyzn grupy cięższej w latach 1995–1999 (zmienne w kolumnach: MH 95 – cięższe kategorie w 1995 r., MH 96 – cięższe kategorie w 1996 r., MH 97 – cięższe kategorie w 1997 r., MH 99 – cięższe kategorie w 1999 r.)

Techniques /Techniki	MH 95	MH 96	MH 97	MH 99	Row Total/Ogółem
<i>Te-waza</i>	46 18.40%	44 22.80%	47 22.71%	46 17.62%	183 20.09%
<i>Ashi-waza</i>	91 36.40%	83 43.01%	77 37.20%	114 43.68%	365 40.07%
<i>Koshi-waza</i>	11 4.40%	11 5.70%	14 6.76%	28 10.73%	64 7.03%
<i>Sutemi-waza</i>	42 16.80%	34 17.62%	32 15.46%	37 14.18%	145 15.92%
<i>Osaekomi-waza</i>	43 17.20%	13 6.74%	12 5.80%	12 4.60%	80 8.78%
<i>Kansetsu-waza</i>	12 4.80%	8 4.15%	1 0.48%	5 1.92%	26 2.85%
<i>Shime-waza</i>	5 2.00%	0 0.00%	0 0.00%	1 0.38%	6 0.66%
Other/Inne	0 0.00%	0 0.00%	24 11.59%	18 6.90%	42 4.61%
Column Total /Ogółem	250 27.44%	193 21.19%	207 22.72%	261 28.65%	911 100.00%

Chi-Square (chi-kwadrat) = 97.28; Df = 18; P-Value (P) = 0.0000; Contingency Coeff. (współczynnik zbieżności) = 0.348

Tab. 10. Temporal structure of judo match ($\bar{x} \pm SD$)
Tab. 10. Struktura czasowa walki dżudo ($\bar{x} \pm SD$)

Author(s)/Autorzy	Activity (sec) /Wysiłek [s]	Pause (sec) /Przerwa [s]
Castarlenas & Planas (1997)	18.0 ± 8.5	12.4 ± 4.1
Monteiro (1995)		
1 min of contest	25.8 ± 7.8	9.5 ± 3.2
2 min of contest	27.0 ± 9.0	10.4 ± 4.5
3 min of contest	27.0 ± 9.7	13.4 ± 7.6
4 min of contest	22.4 ± 9.3	13.2 ± 7.3
5 min of contest	18.9 ± 10.4	13.9 ± 9.0
Sikorski et al. (1987)	30.0	13.0
Sterkowicz & Maślej (1998)	25.1	10.3

some judo athletes are trying to find different solutions to surprise their opponents and obtain a score. This result may be a source of discussion about the traditional judo classification system [4].

Those findings can be useful for the organization and management of big sports events, and choosing the proper training tasks for the athletes by the coaching staff too.

It will not be surprising for us if in the future the International Judo Federation would like to change rules by shortening the time of the fight and giving competitors a more chance to fight in *Ne-waza*.

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SUMMARY

Sposób walki zawodników dżudo podczas mistrzostw świata i igrzysk olimpijskich w latach 1995–1999

Celem badań była charakterystyka walki zawodników dżudo podczas najważniejszych zawodów międzynarodowych. W analizie statystycznej przebiegu 1558 walk oraz 4813 akcji techniczno-taktycznych, które były zarejestrowane podczas mistrzostw świata w latach 1995, 1997, 1999 oraz Igrzysk Olimpijskich w 1996 r., uwagę skupiono na ocenach sędziowskich, z zachowaniem podziału na punkty dodatnie (*Ippon* = 10 pkt., *Waza-ari* = 7 pkt., *Yuko* = 5 pkt., *Koka* = 3 pkt.) oraz punkty karne za akcje niedozwolone przepisami sportowymi (*Hansokumake* = -10 pkt., tj. dyskwalifikacja, *Keikoku* = -7 pkt., *Chui* = -5 pkt., *Shido* = -3 pkt.). Uwzględniono również tradycyjną klasyfikację technik rzutów i chwytów (*Te-waza* = rzuty ręczne, *Koshi-waza* =

= rzuty biodrowe, *Ashi-waza* = rzuty nożne, *Osaekomi-waza* = trzymania, *Kansetsu-waza* = dźwignie na stawy, *Shime-waza* = duszenia) oraz czas (kiedy były skutecznie stosowane w walce z dokładnością do 1 s).

Zmiennymi niezależnymi wobec powyższych charakterystyk startu czołowych dźudoków był rok rozgrywania kolejnych zawodów (w latach 1995–1999), a także kategoria wagowa uczestników. Dane dotyczące kategorii wagowych ($n = 7$) zostały podzielone na dwie grupy: (A) kategorie lżejsze – do 78 kg lub 81 kg (na Mistrzostwach Świata w 1999 r.); (B) kategorie cięższe – powyżej 78 kg lub 81 kg (na Mistrzostwach Świata w 1999 r.). Dokumentacji z turnieju „open” Międzynarodowej Federacji Judo nie analizowano, gdyż tej kategorii nie rozgrywa się na igrzyskach olimpijskich. W lżejszych i cięższych kategoriach wagowych rozpatrywano następnie tendencje szkoleniowe dotyczące zarówno proporcji ocen sędziowskich w kolejnych latach, profilu wyszkolenia technicznego, jak i czasu trwania walki. Zbadano rozkłady częstości występowania zdarzeń na macie podczas walk dźudo, stosując analizę statystyczną testem niezależności cech chi-kwadrat, natomiast weryfikacji siły związku dokonano obliczając wartość skorygowanego współczynnika kontyngencji C-Pearsona. Dla danych ilościowych obliczono przeciętne charakterystyki liczbowe (średnią arytmetyczną i medianę) oraz miary zmienności (odchylenie standardowe).

Na tej podstawie sformułowano spostrzeżenia i wnioski. W latach 1995–1999 zaobserwowano nieznaczną tendencję do zmniejszania się liczby walk toczonych w piątej minucie; była ona wyraźniejsza w cięższej kategorii wagowej. Największy wpływ na uzyskanie zwycięstwa przed czasem *Ippon-gachi* miały umiejętnie stosowane techniki rzutów nożnych *Ashi-waza*, ręcznych *Te-waza*, rzuty z upadkiem atakującego zawodnika *Sutemi-waza*, a następnie – sposoby trzymań w parterze *Osae-waza* i rzuty biodrowe *Koshi-waza*. W mniejszym natomiast stopniu do zakończenia i zmagania przed czasem przyczyniały się skuteczne dźwignie na stawy *Kansetsu-waza*, duszenia *Shime-waza* oraz kary wymuszone na przeciwniku za przekraczanie przepisów walki sportowej.

Niezależnie od kategorii wagowej największą liczbę działań odnotowali sędziowie w pierwszych trzech minutach pięciominutowej walki, a kary stanowiły niemal połowę ocenionych akcji. W piątej minucie walki częściej niż techniki nożne *Ashi-waza* stosowano rzuty ręczne *Te-waza*, rzuty biodrowe *Koshi-waza* oraz dźwignie na stawy *Kansetsu-waza* i duszenia *Shime-waza*.

W latach 1995–1999 zaobserwowano częstsze stosowanie rzutów nożnych *Ashi-waza* w obu kategoriach wagowych; przy tym w wadze cięższej przeważały one nad rzutami ręcznymi, natomiast zróżnicowanie proporcji technik nożnych i ręcznych w kategorii lżejszej było mniejsze.

W kolejnych zawodach w latach 1995–1999 zmniejszał się procentowy udział ocen za skuteczne wykonywanie technik rzutów i chwytów (*Ippon*, *Waza-ari* i *Yuko*), a zwiększał procent kar *Hansokumake*, *Keikoku* oraz *Shido*, szczególnie w cięższych kategoriach wagowych; w 1997 r. zarejestrowano techniki spoza tradycyjnego systemu klasyfikacji.

Wyniki badań zostały przedyskutowane na tle aktualnego piśmiennictwa, przy tym wyeksponowano m.in. ustalenia dotyczące pięciokrokowego algorytmu logicznego walki dźudo, który obejmuje: rozpoznanie silnych i słabych stron przeciwnika; skrywanie własnych zamiarów, powstrzymanie aktywności w ataku i zmniejszenie możliwości obrony przeciwnika przez narzucenie własnego sposobu uchwytu, dystansu, tempa i miejsca działań na macie; zastosowanie ataku skutecznego w ocenie sędziów; powiększenie przewagi i zakończenie walki przed czasem w stojące lub w parterze.

Rezultaty badań mogą być użyteczne podczas organizacji kierowania dużymi turniejami dźudo, a także ułatwić kadrze szkoleniowej racjonalny dobór zadań treningowych dla zawodników wysokiej klasy.