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Technical and Tactical Aspects that Differentiate Winning and Losing Performances in Elite Male Karate Fighters

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ABSTRACT

The purpose of this research was to identify the fighters' technical and tactical activity indicators in order to determine indicator significance regarding situational efficiency and designation between winning and losing performances in a karate match. We scientifically observed a sample of 274 male contesters of 137 karate matches during the 2008 World Karate Championship in Tokyo. Each individual competitor was observed in maximum of three matches. The matches were recorded using a DVD camera in order to collect data for further analysis, and the sample was further described using 48 technical and tactical indicators of situational efficiency and match outcome variables. The obtained results indicate that a karate match is composed of 91% of non-scoring techniques and 9% of scoring techniques in the total technique frequency. On this basis a significant difference in the situational efficiency between the match winners and the losing contesters has been discovered. Those two groups of fighters exhibit a statistically significant difference ($p<0.05$) in 11 out of 21 observed variables of situational efficiency in the table of derived situational indicators. A prevalence of non-scoring techniques suggests that energy demand and technical and tactical requirements of a karate match are in the largest extent defined by non-scoring techniques. Therefore, it would be a grave mistake to disregard non-scoring karate techniques in any future situational efficiency studies. It has been discovered that the winners differ from the defeated contesters by a higher level of situational efficiency in their executed techniques, which incorporate versatility, biomechanical and structural complexity, topological diversity and a specific tactical concept of technique use in the attack phase.

Key words: *martial arts, situational efficiency, technique frequency, tactical concept, karate fighters*

Introduction

A karate match can be interpreted as a particular order of activities which a contestant has to perform, considering the specifications of the opponent and the phase of the contest, within the defined context of a karate match. It is assumed that the indicators of the technical and tactical efficiency in a sports contest are defined by the activity realization levels which each contestant has to perform, with regard to characteristics of the opponent and phase of the contest. Therefore, the total motoric activity, together with the behavior of each fighter during the attack and counterattack phase, depends on the objectives and realization of a specific activity during a fight.

The question is which activities exert influence in a karate match, and to what degree do they determine the outcome of a match. If the level of influence of each activity in a match was to be determined, the success of each fighter could be measured through the level of realization of each activity or a set of activities. It is the basis for objective evaluation of an individual contester or a team in both positive and negative dimensions, via technical and tactical indicators of situational efficiency. Considering the fact that the highest quantity of information emitted in a match is incorporated in a summary registration of technical and tactical indicator frequency, it is presumed that the estimate of analyzed situational efficiency of karate fighter is possible using derivative condensation (compression) method for certain technical and tactical indicators of situational efficiency.

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The concept of a karate match is actualized with successful performance of activities, while it is objectified using the indicators of situational efficiency (match statistics). The activity in a sports match becomes measurable through situational (competitive) efficiency using registration of technical and tactical indicators of situational efficiency. In the existing compendium only a small number of studies describe the situational technical and tactical indicators in a karate match[1–5] whilst only the studies[2,6,7] represent a more precise study of the technical and tactical indicators, specifically of marked techniques frequency in a karate fight. The most recent research makes inquiry into point differences between the techniques comparing the earlier and present rules of point scoring[8]. Alongside these indicators, a karate match is also comprised of a large number of other technical and tactical activities, such as movements (tai no ido) and performed non-scoring techniques, which, together with scoring techniques, represent and define the totality of a karate fight[9].

These exact indicators define energetic[10–12], technical and tactical efficiency of a karate fighter[9] in the highest degree. None of the available studies contained information about the rate of frequency between the scoring and non-scoring technical and tactical indicators and situational efficiency when considering victory or defeat in a karate match. This complicates the comparison of gathered results, but also makes the gained results more valuable. Situational efficiency, as the success in a karate match, depends to a great extent on the ability to carry out various structures of motion, in a different manner and from variable distances. Karate practitioners must thus obtain the exact information about utilization of various structures of motion which involve the efficiency during the match. Therefore, there is a great motive to identify both technical and tactical indicators[13].

Consequently, in order to restrict the apparent dominance of the arm techniques, considering the total efficiency in a match, it is necessary to observe the aggregate of performed techniques during the generalization of the results through the prism of the point scoring system; 1 point (ipon), 2 points (nihon) and 3 points (sanbon)[14].

The purpose of this research is to identify the indicators of technical and tactical activities of the competitors in order to determine the significance of the indicators in relation to the situational efficiency and designation of the winners and losers of a karate match.

Methods

Population and sample entity

The sample was comprised of the total of 274 competitors who took part in 137 matches. Each individual competitor was observed in maximum of three matches (Table 1 and Table 2). All of the competitors were seniors – male, older than 18 years, and participants of the 19th World Karate Championship, which took place in Tokyo in 2008. The competitors originated from 97 countries from five continents (Africa, America, Asia, Australia and Europe).

TABLE 1
OBSERVED MATCHES ACCORDING TO COMPETITION PHASE

Weight category	1st round	2nd round	3rd round	semifinals	finals
–60	17	12	4	2	1
–65	19	14	4	2	1
–70	22	18	4	2	1
–75	20	17	3	2	1
–80	21	19	4	1	1
80	21	18	4	2	1
Open	7	4	2	2	1

TABLE 2
OBSERVED MATCHES ACCORDING TO WEIGHT CATEGORY

Weight category	Total matches in category	Number of matches observed	%
–60	52	36	69.25
–65	61	40	65.57
–70	68	47	69.11
–75	70	43	61.42
–80	65	46	70.76
80	61	46	75.40
Open	78	16	20.51

Sample variables

The sample variables in this study were:

- 12 descriptive technique and tactics variables divided into individual non-scoring attack techniques (»TEH«nn), individual scoring attack techniques (»TEH«bn), individual non-scoring counterattack techniques (»TEH«nk) and individual scoring counterattack techniques (»TEH«bk).

  Kizame tsuki (KT_nn, KT_bn, KT_nk, KT_bk)

  Gyaku tsuki jodan (GYJ_nn, GYJ_bn, GYJ_nk, GYJ_bk,)

  Gyaku tsuki chudan (GYC_nn, GYC_bn, GYC_nk, GYC_bk)

  Mawashi geri chudan (MWC_nn, MWC_bn, MWC_nk, MWC_bk)

  Ashi mawashi geri chudan (AMWC_nn, AMWC_bn, AMWC_nk, AMWC_bk)

  Mawashi geri jodan (MWJ_nn, MWJ_bn, MWJ_nk, MWJ_bk)

  Ashi mawashi geri jodan (AMWJ_nn, AMWJ_bn, AMWJ_nk, AMWJ_bk)

  Ura mawashi geri jodan (UMWJ_nn, UMWJ_bn, UMWJ_nk, UMWJ_bk)

  Ashi ura mawashi geri jodan (AUMWJ_nn, AUMWJ_bn, AUMWJ_nk, AUMWJ_bk)

Ushiro mawashi geri jodan (UMWJ -nn, UMWJ_bn, UMWJ_nk,UMWJ_bk)

Nage waza-tsuki (NWTS_nn, NWT_bn, NWT_nk, NWT_bk)

Other techniques (OT_nn, OT_bn, OT_nk, OT_bk)

- Descriptive variables of the contest outcome: win (PJ) and loss (PZ).

Methods of data analysis

The data was extracted through the analysis of the digital records of 274 karate combats which took place during the 2008 World Karate Championship in Tokyo. All the matches were recorded using a Samsung digital DVD camera. The data was officially registered by three trained and experienced evaluators from Combat Sports Department of University of Zagreb Faculty of Kinesiology. The evaluators have observed each fight according to the interobserver agreement. The criteria for the registration of each technique (frequency) were:

- scoring technique (realized) represented every technique marked by the judge,
- non-scoring technique (unrealized) represented every technique which was not marked by the judge, and which was performed in a full range of motion,
- attacking technique represented every technique performed prior to the reaction of the opponent,
- counterattacking technique represented every technique performed after, or as a reaction to the opponent's attack.

The reliability of the evaluators was very high (kappa coefficient 0.94). The analysis included the frequencies of 12 techniques in order to estimate the individual indicators of the technical and tactical activities which were further recalculated as indicators of situational efficiency technique and overall situational efficiency during the match. The derived data used to estimate the impact of situational efficiency of karate athletes was based on the initial data matrix. For the purposes of calculation, each of the two stages of the karate match (attack and counterattack) had been given numerical ratio scale values, which were later used in statistical analysis. The method of objective assessment of situational effect of karate athletes through technical and tactical situational efficiency indicators was calculation through Spearman's rank correlation coefficient (r=0.60, p=0.05) between variables PJ-PZ (win-loss) and UK_SE (total situational efficiency in a fight) for groups of winners and defeated candidates, according to the decision of the judge. The basic statistical parameters (arithmetic mean, standard deviation, minimum and maximum results and measures of asymmetry

TABLE 3
WINNERS

Variable	$\overline{X}$	s	min	max	R_{tot}	a_3	a_4	MaxD
SE_KTbn	2.89	6.22	0.00	33.33	33.33	2.72	8.43	0.43
SE_KTbk	1.33	5.60	0.00	33.33	33.33	4.72	22.89	0.53
SE_GYJbn	6.84	10.22	0.00	33.33	33.33	1.61	1.64	0.31
SE_GYJbk	3.88	8.06	0.00	33.33	33.33	2.41	5.63	0.43
SE_GYCbn	5.91	8.64	0.00	33.33	33.33	1.61	2.30	0.33
SE_GYCbk	4.24	8.44	0.00	33.33	33.33	2.14	4.09	0.44
SE_MWCbn	4.19	12.25	0.00	66.67	66.67	3.05	8.84	0.51
SE_MWCbk	0.97	8.00	0.00	66.67	66.67	8.21	66.44	0.53
SE_MWJbn	2.54	15.19	0.00	100.00	100.00	6.09	36.43	0.54
SE_MWJbk	1.45	11.99	0.00	100.00	100.00	8.21	66.44	0.53
SE_AMWJbn	0.72	6.00	0.00	50.00	50.00	8.21	66.44	0.53
SE_AMWJbk	0.72	8.51	0.00	100.00	100.00	11.75	138.00	0.53
SE_UMWJbn	2.30	13.25	0.00	100.00	100.00	6.48	43.84	0.53
SE_UMWJbk	0.72	8.51	0.00	100.00	100.00	11.75	138.00	0.53
SE_AUMWJbn	2.54	15.19	0.00	100.00	100.00	6.09	36.43	0.54
SE_AUMWJbk	0.72	8.51	0.00	100.00	100.00	11.75	138.00	0.53
SE_NWTbn	0.79	5.50	0.00	50.00	50.00	7.45	57.84	0.53
SE_NWTbk	3.62	17.76	0.00	100.00	100.00	4.99	24.13	0.54
SE_OTbn	0.24	2.84	0.00	33.33	33.33	11.75	138.00	0.53
SE_Otbk	0.72	8.51	0.00	100.00	100.00	11.75	138.00	0.53
UK_SE	7.41	4.97	1.39	25.00	23.61	1.17	1.26	0.12

$\overline{X}$ – arithmetic mean, s – standard deviation, min – minimum, max – maximum, Rtot – total result range, a3 – skewness, a4 – kurtosis, MaxD – maximal difference between cumulative variable frequency and cumulative e frequency expected for a normal distribution

and curvature distribution) have been calculated for each group. The differences between the winners and defeated candidates for each derived variable of situational efficiency were calculated using the Mann-Whitney statistically significant difference test. The normality of variable distribution was tested using Kolmogorov-Smirnov test for the results obtained in the basic situational efficiency variables. The registration of situational indicators was carried out with the help of specialized software package DARTFISH 4.5.2.0. The data were verified for consistency and entered into a program for statistical data analysis Statistics 7 (StatSoft Inc., Tulsa, USA).

Results

The performed non-scoring techniques compose almost 91% of frequencies in a karate fight, whilst the performed scoring techniques compose merely 9%. These results indicate that the low frequency of scoring techniques account for lower values in a situational efficiency calculation when considering the absolute value of situational efficiency of any given technique.

Tables 3–4 present descriptive parameters and results of Kolmogorov-Smirnov normality distribution test for the derived variables of situational efficiency (Table 3).

It is noticeable that almost every variable exhibits a statistically significant deviation from the normal distribution (maxD>TEST), except for UK_SE variable (total situational efficiency) with value of 0.12. The majority of the variables exhibit a positive asymmetry (a3) towards the high value zone. In the derived variables of situational efficiency of foot techniques and throwing techniques, which are structured as nihon (2 point) and sanbon (3 point) scoring techniques, positive asymmetry is strongly emphasized.

Somewhat lower asymmetry is noticeable only in SE_NWCbn (mawashi geri chudan attack) variable (3.05). The asymmetry is not so emphasized in the performed situational efficiency arm technique variables, which are structured as ipon (1- point) techniques: SE_GYJbn – gyaku tsuki jodan attack (1.61), SE_GYCbn – gyaku tsuki chudan attack (1.61), SE_GYCbk – gyaku tsuki chudan counterattack (2.14), SE_GYJbk – gyaku tsuki jodan counterattack (2.41), SE_KTbn – kizame tsuki attack (2.72) i SE_KTbk – kizame tsuki counterattack (4.72) and UK_SE variable – total situational efficiency (1.17). (Table 4)

From the descriptive parameter matrix (Table 4) it is noticeable that nearly all variables exhibit a statistically significant deviation from normal distribution (maxD> TEST).

TABLE 4
GROUP DEFEATED

Variable	$\overline{X}$	s	min	max	R_{tot}	a_3	a_4	MaxD
SE_KTbn	1.28	4.90	0.00	33.33	33.33	4.91	27.03	0.51
SE_KTbk	0.72	4.88	0.00	33.33	33.33	6.63	42.59	0.54
SE_GYJbn	1.87	5.67	0.00	33.33	33.33	4.20	19.62	0.46
SE_GYJbk	0.78	2.57	0.00	16.67	16.67	3.73	14.91	0.52
SE_GYCbn	1.46	4.58	0.00	33.33	33.33	4.20	21.18	0.49
SE_GYCbk	0.36	1.99	0.00	16.67	16.67	6.20	41.47	0.54
SE_MWCbn	0.48	5.68	0.00	66.67	66.67	11.75	138.00	0.53
SE_MWCbk	0.00	0.00	0.00	0.00	0.00	–	–	1.00
SE_MWJbn	0.00	0.00	0.00	0.00	0.00	–	–	1.00
SE_MWJbk	0.72	8.51	0.00	100.00	100.00	11.75	138.00	0.53
SE_AMWJbn	0.00	0.00	0.00	0.00	0.00	–	–	1.00
SE_AMWJbk	0.00	0.00	0.00	0.00	0.00	–	–	1.00
SE_UMWJbn	0.00	0.00	0.00	0.00	0.00	–	–	1.00
SE_UMWJbk	0.36	4.26	0.00	50.00	50.00	11.75	138.00	0.53
SE_AUMWJbn	0.00	0.00	0.00	0.00	0.00	–	–	1.00
SE_AUMWJbk	0.00	0.00	0.00	0.00	0.00	–	–	1.00
SE_NWTbn	0.14	1.70	0.00	20.00	20.00	11.75	138.00	0.53
SE_NWTbk	0.00	0.00	0.00	0.00	0.00	–	–	1.00
SE_OTbn	0.00	0.00	0.00	0.00	0.00	–	–	1.00
SE_Otbk	0.00	0.00	0.00	0.00	0.00	–	–	1.00
UK_SE	1.68	2.11	0.00	11.11	11.11	1.44	2.51	0.27

$\overline{X}$ – arithmetic mean, s – standard deviation, min – minimum, max – maximum, Rtot – total result range, a3 – skewness, a4 – kurtosis, MaxD – maximal difference between cumulative variable frequency and cumulative e frequency expected for a normal distribution

It is noticeable that almost every variable exhibits a statistically significant deviation from normal distribution (maxD>TEST). The majority of the variables exhibit a positive asymmetry (a3) towards the high value zone. In the derived variables of the situational efficiency of foot techniques and throwing techniques, which are structured as nihon (2 point) and sanbon (3 point) scoring techniques, the positive asymmetry is strongly emphasized. A somewhat lower asymmetry is noticeable only in SE_GYJbk (gyaku tsuki jodan counterattack) variable (3.73). The asymmetry is also lower in the variables of situational efficiency of the performed arm techniques which are structured as ipon (1) scoring techniques: SE_GYJbn – gyaku tsuki jodan attack (4.20), SE_GYCbn – gyaku tsuki chudan attack (4.20), SE_KTbn – kizame tsuki attack (4.91), SE_GYCbk – gyaku tsuki chudan counterattack (6.20) and SE_KTbk – kizame tsuki counterattack (6.63) (Table 5).

Table 5 depicts the results of Mann-Whitney statistically significant difference test between the groups of winners and the defeated contestants in the performed situational efficiency variables. It is noticeable that 11 out of 21 observed situational efficiency variables demonstrate a statistically significant difference ($p<0.05$) between the two groups. The variables which exhibit a statistically significant difference ($p<0.01$) expressed through relative effect size (U/nm) are SE_GYJbn (gyaku tsuki jodan attack) and SE_GYCBN (gyaku tsuki chudan attack) variables, with a relative effect size of 0.35. The winners achieved higher values of ## rank in the mentioned variables of situational efficiency than the defeated contesters. In the winning group the arithmetic mean of ranks for SE_GYJbn (gyaku tsuki jodan attack) variable amounts to 159, whereas for the defeated fighters it amounts to 118. In SE_GYCbn (gyaku tsuki chudan attack) the arithmetic mean of ranks measures 160 for the winners, as opposed to 117 for the defeated contesters.

Discussion

As non-scoring techniques have not been included in any of the previous studies, it can be noticed that there is a need for a methodological orientation toward these techniques, as in this study. Based on the high total frequency of the non-scoring techniques in contests it can be con-

TABLE 5
RESULTS OF THE MANN-WHITNEY STATISTICALLY SIGNIFICANT DIFFERENCE TEST BETWEEN GROUPS OF WINNERS AND DEFEATED CONTESTANTS IN DERIVED SITUATIONAL EFFICIENCY VARIABLES

Variable	$\overline{X}$ ranks		U	z	p	U/nm
	winners	defeated				
SE_KTbn	149	128	8091	3.30	0.000	0.42
SE_KTbk	141	136	9117	1.73	0.081	0.48
SE_GYJbn	159	118	6670	5.28	0.000	0.35
SE_GYJbk	150	127	7919	3.63	0.000	0.42
SE_GYCbn	160	117	6618	5.57	0.000	0.35
SE_GYCbk	154	123	7403	5.22	0.000	0.39
SE_MWCbn	146	131	8426	3.86	0.000	0.44
SE_MWCbk	140	138	9384	1.42	0.162	0.49
SE_MWJbn	141	137	9246	2.01	0.041	0.49
SE_MWJbk	139	138	9453	0.58	0.563	0.50
SE_AMWJbn	140	138	9384	1.42	0.162	0.49
SE_AMWJbk	139	138	9453	1.00	0.322	0.50
SE_UMWJbn	141	136	9177	2.25	0.021	0.48
SE_UMWJbk	139	138	9522	0.01	1.000	0.50
SE_AUMWJbn	141	137	9246	2.01	0.041	0.49
SE_AUMWJbk	139	138	9453	1.00	0.322	0.50
SE_NWTbn	140	137	9383	1.02	0.311	0.49
SE_NWTbk	142	136	9108	2.47	0.012	0.48
SE_OTbn	139	138	9453	1.00	0.323	0.50
SE_Otbk	139	138	9453	1.00	0.324	0.50
UK_SE	193	84	2044	11.36	0.000	0.11

Legend: $\overline{X}$ ranks – arithmetic mean of ranks, U – U value of Mann-Whitney U test, z – calculated z valuable of Mann-Whitney U test, p – minimal error for statistically significant difference between arithmetic mean of ranks, U/nm – relative size effect (0.5 denotes minimal, whereas 0 or 1 denote maximal difference between groups)

cluded that the non-scoring techniques extensively define energy requirements along with the technical and tactical aspects of a karate fight.

The question is whether this significant ratio difference between the scoring and non-scoring techniques is caused by a low level of tactical efficiency in karate practitioners or by a high frequency of usage of composite technical combinations. It is certain that composite combinations, which are commonly used to »conceal« the main point-scoring technique, or to create favorable conditions for its use, are partly responsible for significant difference in frequencies between the scoring and non-scoring techniques in a karate match.

Based on the observed results for the winning group it can be surmised that two and three point techniques significantly affect the higher values of performed situational efficiency technique variables which are structured as NIHON and SANBON techniques, namely foot techniques and throwing techniques. Consequently, the positive asymmetry as a reflection of the result grouping in high value zone is obvious, especially in foot techniques and three point techniques (sanbon). According to the dispersion degree (Table 3), a relatively high variability of certain performed situational efficiency variables is noticeable. It is necessary to emphasize that all the total values of the performed situational efficiency variables were divided by three in order to obtain a value positioned within the 0 to 100 range. The interpretation of the efficiency is significantly simplified in this manner, because the value of the results in situational efficiency variable is realized on a scale with a known absolute value of 100. The important values in this interpretation are the values of arithmetic mean variable indicators, which are more significant in arm attack techniques SE_GYJbn (gyaku tsuki jodan attack) with 6.84, SE_GYCbn (gyaku tsuki chudan attack) with 5.91 and counterattack techniques SE_GYCbk (gyaku tsuki chudan counterattack) with 4.24 and SE_GYCbk (gyaku tsuki jodan counterattack) with 3.88. For the performed variables of other techniques the values of arithmetic mean indicators were statistically more significant in variables SE_MWCbn (mawashi geri chudan attack) with 4.19 and SE_NWTbk (nage waza tsuki counterattack) with 3.62. It can be noticed that the arm technique variables show a low span of results (from 0 to 33.0). A high arithmetic mean combined with such a low span of results indicates a high effect of arm techniques on point scoring. Furthermore, it can be noticed that the arithmetic means of all of the performed situational efficiency variables are the same or higher in the performed situational efficiency attack variables. As both groups of variables have an equal or closely similar result span, it can be concluded that the winning group scores points in the technical and tactical attack phase significantly more often.

The performed UK_SE (total situational efficiency) variable has a high arithmetic mean of 7.41, as opposed to the other performed variables, especially on the account of the lower range of results (from 1.39 to 25.0). An arithmetic mean with such a high value and a low range of results indicates that the results in the UK_SE (total situational efficiency) variable have a distinctly different calculation system from other variables, which makes them incomparable. In other words, it means that the average situational fight efficiency in the winning group is amounted to 7.41.

Based on the results of the degree variability of performed situational efficiency variables in the winning group it can be confirmed that the majority of the results vary considerably throughout the variables, except for the variables SE_GYJbn (gyaku tsuki jodan attack), SE_GYCbn (gyaku tsuki chudan attack) and UK_SE (total situational efficiency). It is noticeable that only a small percentage of arithmetic mean values in these variables matches the value of the standard deviation.

In relation to the winning group (Table 3) only four weighted two and three point techniques in the defeated group (Table 4) significantly affect the higher values of performed situational efficiency technique variables which are structured as foot and throwing techniques (NIHON and SANBON respectively). Those techniques are SE_MWCbn (mawashi geri chudanattack), SE_MWJbk (mawashi geri jodan counterattack), SE_UMWJbk (ura mawashi geri jodan counterattack) and SE_NWTbn (naga waza tsuki attack). According to the derived results, the positive asymmetry between the mentioned variables is understandable as a reflection of result grouping in the high value zone. There are no results for the other techniques as they have not effected the dispensation of any specific indicator (technique) in the total and partial situational efficiency variable in defeated group. According to the dispersion degree (Table 4), a high variability of specific performed situational efficiency variable can be observed in the defeated group. Similarly to the winning group, the arithmetic means of variables in defeated group are significantly higher in hand attack techniques. Those are the variables SE_GYJbn (gyaku tsuki jodan attack) with 1.87, SE_GYCbn (gyaku tsuki chudan attack) with 1.46, SE_KTbn (kizame tsuki attack) with 1.28 and counterattack variable SE_GYCbk (gyaku tsuki chudan counterattack) with 1.46. Lower values in this variable are a result of the highest frequency of this technique in the counterattack phase[9], where it was mostly used by defeated contesters to score points.Furthermore, it can be noticed that the arithmetic means of all the performed situational efficiency variables are equal or similar in the performed attack variables. Based on the equal result range in the attack and counterattack variables, it can be concluded that the defeated contesters achieve a higher point-scoring frequency in the technical and tactical attack phase.

The sole difference between the winning and the losing groups (Table 3 and Table 4) is that the defeated contesters achieve a higher situational efficiency in the counterattack phase as opposed to the attack phase in two variables: SE_MWJbk (mawashi geri jodan counterattack) and SE_UMWJbk (ura mawashi geri jodan counterattack).

It can be observed that the hand technique variables demonstrate a low range of results (from 0 to 33.0) which

means that their high arithmetic mean and a low range of results significantly affect the frequency of scoring points using hand techniques.

The analysis of Table 3 and Table 4 can reveal that the arithmetic means of situational efficiency variables in the winning group are significantly higher than the arithmetic means of situational efficiency variables in the defeated group. This information confirms the pragmatic values of this methodological approach based on the situational efficiency technique calculation, which successfully differs between the winners from the defeated contesters. In this way it is possible to conclude that the winning and the defeated groups were mostly differed by the arithmetic means of the performed situational efficiency technique variables SE_GYJbn (gyaku tsuki jodan attack) and SE_GYCbn (gyaku tsuki chudan attack), as depicted in the Table 3 and Table 4. Moreover, it can be observed that both of these variables represent the technical and tactical attack concept. In this way it can be stated that the variables which extensively influence the difference between the two groups are marked by the same technical and tactical fighting concept. In the same way, by observing the totality of the variables which exhibit a statistically significant difference ($p<0.05$) in the distinction between the winning and the defeated groups, it can be detected that 7 out of 10 are attack variables. Tables 3 and 4 suggest that the winning group displays a higher arithmetic mean values in all of the observed variables.

It can be concluded that the technical and tactical fight concept in the winning group is mostly defined by the attack variables. The winning group is differentiated from the defeated group by the total of seven performed situational efficiency variables in the attack phase: SE_GYJbn (gyaku tsuki jodan – attack), SE_GYCbn (gyaku tsuki chudan – attack), SE_KTbn (kizame tsuki – attack), SE_MWCbn (mawashi geri chudan – attack), SE_UMWJbn (ura mawashi geri jodan – attack), SE_AUMWJbn (ashi ura mawashi geri jodan – attack) and SE_MWJbn (mawashi geri jodan – attack). A total of three performed situational efficiency in the counterattack phase differentiate the winning and the defeated groups: SE_GYCbk (gyaku tsuki chudan – counterattack), SE_GYJbk (gyaku tsuki jodan – counterattack) and SE_NWTbk (nage waza tsuki – counterattack). Furthermore, it can be concluded that the aforementioned variables, more specifically scoring techniques, as carried out by the winning group, are mostly defined by the use of composite combinations and structures of scoring techniques within combinations in both attack and counterattack phases.

These results indicate that the winners commonly took the initiative throughout the fight, more easily outdistanced their opponents and were essentially more dynamic and active during the fight. The analysis of Table 5 implies the existence of an equal distribution among five performed arm techniques and five performed foot and throwing techniques which differ between the winning and the defeated groups in a statistically significant way ($p<0.05$). The comparison of Tables 3 and 4 suggests that the arithmetic means of all the performed situational efficiency variables are higher in the winning group. Hence, it can be concluded that the fighters in the winning group differ from the fighters in the defeated group by their higher level of situational efficiency in the aforementioned variables, diversely performed during the technical and tactical attack phase. The mentioned techniques are structurally complex for both training and application and require a high level of motoric ability for their successful realization.

Consequently, it is possible to assume that the contesters who achieve victory using technically more demanding and complex technical and tactical motions and techniques are motorically superior. UK_SE (total situational efficiency) is a variable which exhibits the largest difference in a statistically significant way ($p<0.01$) in the relative effect size group (U/nm) with a value of 0.11. It can be concluded that the achieved result value of the total situational efficiency variable can be used to successfully differ the winning from the defeated candidates. This fact is further affirmed by the statistically significant correlation coefficient of 0.60 between the variables PJ_PZ (victory – defeat) and UK_SE (total situational efficiency)[15].

Conclusion

Based on the empirical evaluation of the collected situational indicator data from the elite karate fighters it is possible to conclude the following:

In the total technique frequency, a karate fight is comprised out of 91% of non-scoring and 9% of scoring techniques. A frequency this high suggests that it is the non-scoring techniques that mainly affect the technical and tactical demands in a karate match. According to the derived results for the winning group, it can be assumed that the two- and three-point techniques significantly affect the values of the performed situational efficiency variables in foot and throwing (NIHON and SANBON) techniques. This implies that omitting the non-scoring techniques from any future methodological situational efficiency studies would present a serious error.

Furthermore, it has been confirmed that the fighters from the winning group differ from the fighters in the defeated group in a statistically significant way ($p<0.05$) in 11 out of 21 observed situational efficiency variables. The fighters in the winning group differ from the defeated contesters by their higher level of situational efficiency in the mentioned variables, performed in diverse topological, biomechanical and structural ways. The mentioned variables (techniques) are structurally complex for training and application, and demand a higher level of motoric ability for their successful realization.

This study has presented the manners in which the identified differences in situational efficiency indicators between the winning and the defeated fighters specify the direction for a successful technical and tactical training modeling, potentially mitigating the current issues which impede the possibility of reaching the top results in karate.

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TEHNIČKO-TAKTIČKE KARAKTERISTIKE POBJEĐENIH I PORAŽENIH BORACA U KARATE BORBI

SAŽETAK

Predmet ovog istraživanja bio je utvrditi pokazatelje tehničko-taktičkih aktivnosti borca, kako bi se utvrdila značajnost pokazatelja u odnosu na situacijsku efikasnost i diskriminiranje pobjednika i poraženih boraca u karate borbi. Za ostvarenje navedenih ciljeva korišten je uzorak od ukupno 274 seniorskih natjecatelja u 137 borbi, koji su sudjelovali u najviše tri borbe tijekom Svjetskog prvenstva u karateu 2008. godine u Tokyu. Tako odabran uzorak karataša opisan je sa 48 tehničko – taktičkih pokazatelja situacijske efikasnosti i varijable ishod borbe. Iz tako prikupljenih podataka izvedene su varijable za procjenu ukupnog situacijskog učinka karataša u borbi i parcijalnih situacijskih učinaka po tehnici Dobiveni su rezultati koji ukazuju kako u ukupnoj frekvenciji tehnika, karate borbu sačinjava 91% nebodovanih tehnika i 9% bodovanih tehnika. Ovako visoka frekvencija ukazuje kako nebodovane tehnike u najvećoj mjeri definiraju energetske i tehničko-taktičke zahtjeve karate borbe. To znači da bi se u budućnosti činila velika greška ukoliko bi metodološka orijentacija istraživanja situacijske efikasnosti zanemarila nebodovane tehnike u karate borbi. Na temelju izvedenih varijabli za procjenu situacijskog učinka karataša utvrđeno je da postoje razlike između situacijske efikasnosti tehnika kod pobjednika i poraženih boraca, te da se pobjednici i poraženi natjecatelji u izvedenim situacijskim pokazateljima statistički značajno ($p<0,05$) razlikuju u 11 od 21 promatrane varijable situacijske efikasnosti. Dobiveno je kako se pobjednici od poraženih boraca razlikuju u višoj situacijskoj efikasnosti izvedenih tehnika koje odlikuje raznovrsnost, biomehanička i strukturalna složenost, različita topološka zastupljenost i taktički koncept upotrebe tehnika koje se najviše događaju u fazi napada.