CORRELATION OF THE ACTUAL AND THE SUBSTITUTE COMPETITIVE RESULT IN KAYAK SLALOM

Aleks Leo Vest*

ZVEZA MED DEJANSKIM IN NADOMESTNIM REZULTATOM V KAJAK SLALOMU

ABSTRACT

Competitive capability doesn't always manifest itself entirely in each result, due to the changing dynamics of various known and unknown factors. Non-standard conditions in individual kayak-slalom races present further difficulties. The competitive result is the sum of achieved time and penalty points - usually the consequence of technical errors - which are unpredictable and because of their random nature an unstable and unrealistic indicator of competitive capability. Twelve kayakers co-operated at four races in assessing the correlation between the actual and substitute result. Best times and results at individual races were taken as indicators of the actual competitive result and velocity in figure of eight test as the substitute result. Inspection of correlation stability between the actual and substitute result in different conditions showed that the effort in figure of eight test closely matches that in kayak-slalom. Ranges of correlation coefficients between best achieved times at different races, actual results and substitute result give credibility to the supposition of a common basis of these indicators and that the velocity in figure of eight test is an adequate indicator for assessing competitive capability in kayak-slalom. This test enables an insight into those energy characteristics that most (co)define the actual competitive result.

Key words: kayak slalom, theory of training, substitute competitive result

IZVLEČEK

Zaradi spreminjajoče se dinamike znanih in neznanih dejavnikov, se tekmovalna zmogljivost ne udejanja celovito v vsakem tekmovalnem rezultatu. V kajak slalomu povzročajo dodatno težavo nestandardni pogoji, v katerih se tekmovanja odvijajo. Tekmovalni rezultat je seštevek doseženega časa in pribitka kazenskih točk, ki so praviloma posledica tehničnih napak, so nepredvidljive in zaradi slučajnosti dogodka nestabilen in nerealen kazalec tekmovalne zmogljivosti. Pri preverjanju povezanosti dejanskega in nadomestnega tekmovalnega rezultata je na štirih različnih tekmah sodelovalo 12 kajakašev. Za kazalce dejanskega tekmovalnega rezultata so bili uporabljeni najboljši doseženi časi in rezultati na posameznih tekmah, za kazalec nadomestnega rezultata je bila uporabljena hitrost veslanja v osmici. Preverjanje stabilnosti korelacij med dejanskim in nadomestnim tekmovalnim rezultatom v različnih tekmovalnih pogojih je pokazalo, da je napor pri veslanju v osmici zelo podoben naporu v kajak slalomu. Razponi korelacijskih koeficientov med najboljšimi doseženimi časi na različnih tekmah, dejanskimi rezultati na različnih tekmah in nadomestnim rezultatom, nakazujejo veliko verjetnost, da je osnova teh kazalcev enaka in je hitrost veslanja v osmici primeren kazalec za oceno tekmovalne zmogljivosti v kajak slalomu. Test omogoča nadzor tistih kazalcev energijskih značilnosti, ki najpomembneje sovplivajo na tekmovalni rezultat.

Ključne besede: kajak slalom, teorija treniranja, nadomestni rezultat

*Faculty of Sport, University of Ljubljana, Ljubljana, SLOVENIA

INTRODUCTION

Sports achievements evaluated through results enable one to separate and rank sportsmen according to their quality. Competitive capability does not always manifest itself entirely in each result, due to the changing dynamics of various known and unknown factors. The non-standard race conditions in some sports – kayak-slalom included – and the way the competitive result is computed present further difficulties. The competitive result in kayak-slalom is namely the sum of the achieved time and the penalty points.

Analyses of the results show that top competitors usually complete the course without penalty points and differ mostly in the achieved time. The penalty points – usually the consequence of technical errors – are unpredictable and because of their random nature an unstable and unrealistic indicator of the actual competitive capability. From this viewpoint the competitive result does not represent the best indicator for assessing competitive capability, especially when the best achieved time does not figure as an integral part of the competitive result. Non-standard wild-water conditions, different gate placements, various constructions of artificial slalom courses and other factors are without doubt an additional specific problem – one which places even the best achieved time among the not-so-reliable indicators of competitive capability.

The unstable conditions from which the competitive result originates do not allow the formation of a perfectly reliable model of energy characteristics of the competitive result. This is why different models of energy characteristics should be used to find new ways of building more reliable and stable competition models. It is only with such indirect approaches that it is possible to gradually substitute the actual competitive result in kayak-slalom with the result in a test on flat water, one that would be closest to the actual competitive situation in kayak-slalom.

Analyses of the competitive results and used technique show that attention should be paid – when searching for a substitute test – mostly to those indicators of competitive capability that decisively influence the velocity of the kayak (6, 8, 9). The selection of energy characteristics indicators for the motor and physiological sub-spaces – ones that would be used in a model of specific characteristics of competitors in kayak-slalom – is based in content on the specifics of kayak-slalom and takes into account relevant scientific findings dealing with measurement (1, 2, 3, 4, 5, 6, 7, 8).

The measurements of energy characteristics indicators were executed in conditions adapted to the specifics of kayak-slalom. Besides situational tests of strength and endurance in strength – measured on the water – laboratory measurements were made of those physiological indicators that could not be measured on the water, here a close simulation of the actual competitive kayak-slalom effort was also strived for, with the use of a special kayak ergometer (9).

On the basis of statistical analyses we chose the velocity in the figure of eight test (VFIG8) as the substitute result. From the correlation table – velocity in the figure of eight test (VFIG8) with the actual competitive result (CRESULT) and the best achieved time (BESTTIME) – it can already be seen that the correlation coefficient is very high (r=-0.96). The results in a stepwise regression analysis also show the good prognostic power of this indicator, as the test (VFIG8) explains the greatest part of the criterion variance in the basic regression equation (R square = 0.926 and sig. F = 0.000) (9). According to these results it seems that the velocity in the figure of eight test is an adequate criterion for assessing competitive capability - satisfying all scientific and sport praxis criteria.

In spite of this there was still the possibility that such high coefficients are not a reliable picture of the correlation between the indicators of competitive capability and the velocity in the figure of eight test. In order to verify further the correlation between the actual and the substitute competitive result, additional measurements were performed of both indicators in different competitive conditions. For the purposes of this assessment the results of selection races for the Slovene national team at Tacen (twice), at Lofer and on the Soča river were used. The races at Tacen were held on an artificial course, while those at Lofer and Soča were on natural slalom courses. These four competitions were held at very different water-levels.

METHODS

Subjects

The sample consisted of twelve subjects of mean age 19 (± 4.3 years), body mass 64.1 (±8.3kg), body height 174 (±7.5 cm) and assessed quality of 2.7 (±1.4) on a five point scale, that took part in the Slovene national team selection races. All subjects did not take part at all the races, the samples were different both in number and structure. At the first race at Tacen twelve subjects competed, at the sec-

ond – also at Tacen – six, twelve at the race on the Soča river and ten at Lofer.

Variables

The measurements of the competitive results were executed for each slalom race separately. The indicators of the actual competitive result were the best achieved time and result (in points) at the individual races at Tacen (TAC1BEST, TAC1RES, TAC2BEST, TAC2RES), on the Soča river (SOČABEST, SOČARES) and the race at Lofer (LOFBEST, LOFRES).

On the basis of prior findings (9) the test figure of eight was chosen as the substitute competitive result. The chosen indicator of substitute result, velocity in the figure of eight test (VFIG8) enables monitoring energy characteristics in kayak-slalom in standardised substitutive competition conditions.

The figure of eight test is performed in a kayak-slalom by paddling in a figure of eight on flat water of depth more than 1 m. The length of the test course is 6 x 50 m and should be completed once, as fast as possible. At the begining, the forward tip of the kayak should be at the starting line. Time measurement begins when the body of the subject crosses the starting line and ends when it crosses the finish line. Times are measured correct to a tenth of a second. Before the test – while in repose – and 3 min. after completion of the test 20 μl of blood is drawn from the ear lobe. The heart frequency is measured every 5 seconds with a pulsemeter.

Statistical methods

Basic statistical parameters were computed for all the variables - arithmetic mean, minimal and maximal result, standard deviation, Kolmogorov and Smirnov coefficient (test of distribution normality) and its statistical significance. The correlation between pairs of variables was assessed with Pearson correlation coefficients. All correlations where alpha error was less than 0.05 were considered statistically significant. All computation was done with the SPSS and CSS statistical packages.

RESULTS

The basic statistical parameters and the test for distribution normality for the actual and substitute competitive results are shown in table 1.

Correlation between indicators of actual competitive result

Pearson correlation coefficients were computed to assess the correlation of the individual indicators of the actual competitive result in different kayak-slalom conditions. These are shown in table 2.

Table 1: Basic statistics of the variables of actual and substitute competition result

Race	*Mean*	*Minimum*	*Maximum*	*Standard deviation*	*K-S coefficient*	*K-S significance*
TAC1BEST	111.717	103.600	118.610	5.052	0.718	0.680
TAC1RES	114.344	103.600	133.570	8.061	0.598	0.867
TAC2BEST	133.197	126.010	144.120	7.698	0.526	0.945
TAC2RES	141.105	132.700	157.400	9.176	0.648	0.795
SOČABEST	109.567	102.690	122.710	6.282	0.997	0.273
SOČARES	111.233	104.000	132.710	8.172	0.955	0.321
LOFBEST	131.527	124.460	144.770	6.866	0.761	0.608
LOFRES	135.332	124.460	153.740	8.437	0.621	0.836
VFIG8	2.534	2.350	2.670	0.960	0.400	0.997

The variable codes stand for the following:
* VFIG8 - velocity in the figure of eight test (m/sec)
* TAC1BEST - best achieved time at the senior's selection race at Tacen (sec)
* TAC1RES - achieved result at the senior's selection race at Tacen (points)
* TAC2BEST - best achieved time at the juniors' selection race at Tacen (sec)
* TAC2RES - achieved result at the juniors' selection race at Tacen (points)
* SOČABEST - best achieved time at the senior's selection race on Soča (sec)
* SOČARES - achieved result at the senior's selection race on Soča (points)
* LOFBEST - best achieved time at the senior's selection race at Lofer (sec)
* LOFRES - achieved result at the senior's selection race at Lofer (points)

Table 2: Coefficients of correlation between the indicators of actual competitive result

	TAC1 BEST	TAC1 RES	TAC2 BEST	TAC2 RES	SOČA BEST	SOČA RES	LOF BEST	LOF RES
TAC1 BEST	1	0.85	0.69	0.44	0.76	0.78	0.91	0.84
TAC1RES	0.85	1	0.18	-0.19	0.71	0.59	0.85	0.91
TAC2BEST	0.69	0.18	1	0.85	0.51	0.78	0.9	0.99
TAC2RES	0.44	-0.19	0.85	1	0.4	0.72	-0.16	-0.57
SOČABEST	0.76	0.78	0.51	0.4	1	0.93	0.83	0.87
SOČARES	0.78	0.59	0.78	0.72	0.93	1	0.85	0.85
LOFBEST	0.91	0.85	0.9	-0.16	0.83	0.85	1	0.9
LOFRES	0.84	0.91	0.99	-0.57	0.87	0.85	0.9	1

*All correlation coefficients with statistical significance $p<0.05$ are shaded

The correlations between the individual competitive results and some indicators of competitive successfulness are mostly very high and statistically significant. This is not true only for the second race at Tacen (TAC2BEST, TAC2RES).

The correlation coefficients between the best times (BEST) and the results at the races (RES) are high for all four races ($r=0.85$ to $r=0.93$, $p<0.01$).

Besides the range of the correlation coefficients for each individual indicator of the competitive result at the same race, the ranges of the correlations between the different groups of indicators of the competitive result at different races are also important. The ranges of correlation between best times (BEST) are between 0.76 and 0.91, while for results (RES) they are between 0.59 and 0.93. The range of correlation coefficients between the best times (BEST) and the results (RES) is from 0.76 to 0.99.

Correlation between indicators of actual and substitute competitive result

To assess the correlation between the actual competitive indicators and the substitute results Pearson correlation coefficients were computed between the figure of eight results and the results of the races in different conditions. The data is shown in table 3.

Table 3: Correlations between indicators of substitute and actual competitive result

	VFIG8		VFIG8
TAC1BEST	-0.84	TAC1RES	-0.61
TAC2BEST	-0.88	TAC2RES	-0.92
SOČABEST	-0.79	SOČARES	-0.82
LOFBEST	-0.76	LOFRES	-0.78

Table three shows that the correlation coefficients between the rowing velocity in the figure of eight test (VFIG8) and the best achieved results (BEST) are very high ($r=-0.76$ to $r=-0.88$). With one exception (TAC1RES, $r=-0.61$), the correlations between the rowing velocity in the figure of eight test (VFIG8) and the achieved competitive result (RES) are somewhat higher, reaching from –0.78 to –0.92.

DISCUSSION

On the basis of the high correlations between the competitive result and the best achieved time (table 2) it is possible to conclude that the achieved time has a decisive role in the final competitive result. This is also confirmed by analyses of the results of slalom competitions of the highest international rank, where the first ten to fifteen competitors as a rule complete the course without penalty points - the best achieved time is therefore also the final result. The influence of the best achieved time on the final result can also be seen in the lower age categories and competitors of lesser quality in cases where the competition was not being held on technically demanding slalom courses.

In a research by A.L.Vest (9) an attempt was made to explain the best achieved time and the velocity in the figure of eight test with the same indicators of energy characteristics. High correlation coefficients were obtained between the velocity in the figure of eight test and individual indicators of competitive successfulness ($r=0.96$). The correlation with the final result, with the best achieved time and also with the time which is an integral part of the final result, confirmed the supposition that velocity in figure of eight test (VFIG8) is an adequate replacement for the competitive result.

Table 4: Correlation bounds

	BEST	*RES*	*VFIG8*
BEST	0.76 to 0.91	0.76 to 0.91	-0.76 to -0.88
RES	0.76 to 0.99	0.59 to 0.93	-0.78(-0.61) to -0.92

The variable codes are:
– BEST - best achieved result at different races
– RES - actual results achieved at different races
– VFIG8 - predictive competition result (velocity in figure of eight test)

The effort in the figure of eight test is, even if performed on flat water, very similar to the effort in kayak slalom - but not equal due to the specifics of the slalom technique on wild water. One would expect the correlation between the actual and the substitute result, represented by the figure of eight test (VFIG8), to be dependent on the technical demands of the slalom course on which the competition took place. Both races at Tacen were at high water level on an artificial course, for which unanticipated dynamics of water formations and resulting technical errors - which decisively influence the achieved time and penalty points - are characteristic. The races on the Soča river and at Lofer were on natural courses, where the water conditions were different, but stable and much more predictable.

Verification of the stability of correlations between the actual (BEST, RES) and the substitute competition result (VFIG8) in different competitive situations showed that they oscillate much in the same bounds as do the intercorrelations between indicators of the actual result (BEST, RES) - see table 4.

The substitution of the actual competitive result with the velocity in the figure of eight test enables one to build a foundation for studying kayak-slalom in more controlled conditions. The magnitude of the correlation coefficients between indicators of the actual and the substitute result show that the indicator of the figure of eight test - velocity in the figure of eight (VFIG8) - is an appropriate indicator for assessing competitive capability in kayak slalom. The figure of eight test is both in regard to its kinematic structure, as well as the load kinetics and duration, a very simplified approximation of the actual competitive situation in kayak-slalom. The reduction of the test mainly to indicators of energy characteristics does not reflect the competitors' complete competitive capability. In spite of the restrictions and wilful elimination of (especially) technical and psychological factors, the correlation coefficients show that the indicators of energy characteristics are the most stable element of competitive capability. The ranges of the correlation coefficients between the best achieved times at various races (BEST), the actual results (RES) and the substitute competitive result (VFIG8) show that there is a high probability that the basis of these indicators is the same.

The indicators contained in the figure of eight test do not give sufficient information on the psychical, technical and tactical competitive capability of the competitor, however, they do enable monitoring of those indicators of energy characteristics that decisively exert influence on the competitive result. The chosen path is of course only one of many possible, its current verification in praxis does show that the chosen test is a step in the right direction - how to assess the competitive capability in kayak-slalom.

References

1. Colli R., Faccini P, Schermi C., Introini E., Dal Monte A.: Das treining des Kanuten (I). Leistungs Sport 1992; 4: 50 - 54.

2. Colli R., Faccini P, Schermi C., Introini E., Dal Monte A.: Das treining des Kanuten (II). Leistungs Sport 1993; 3: 22 - 26.

3. Fry R.W., Morton A.R.: Physiological and kinantropometric attributes of elite flatwater kayakists. Medicine and Science in Sports and Exercise 1991; 11: 1297 - 1301.

4. Hamar D., Tkač M.,Komadel L., Kuthanova O., Vajda R.: Izokineticky padlovaci trenažer v diagnostike trenovanosti kayakarov (Use of the isokinetic kayak apparatus in training diagnostics of kayakists). Teorie a praxe Telesnih Vychovi 1990; 38(3): 133 - 142.

5. Kuta I., Boesswart J., Čermak J.: Vliv ruzne intenzity prace na produkci krevniho laktata v rychlostne kanoistice (The influence of different workout intensities on the production of blood lactate in flat-water canoeing). Teorie a praxe telesnih vychovi 1981; 29: 239 - 240.

6. Sidney K., Shephard R.J.: Physiological characterictis and performance of the whitewater paddler. Europien Journal of Applied Physiology 1973; 32: 55 - 70.

7. Tesch P.:Physiological characteristics of elite kayak paddlers. Canadien Journal of Applied Sport Science 1983; 8: 87 - 91.

8. Ušaj A.: Pregled sedmih Andrejevih tekmovalnih sezon v svetovni eliti kanuistov na divjih vodah (Overview of Andrej's seven competitive seasons in the white-water canoe elite). Šport 1993; 41(3):,16 - 20.

9. Vest A.L.: Model nekaterih energijskih značilnosti kajakašev (Model of some energy-characteristics of water-slalom kayakers). Doctorate, Faculty of Sport, Ljubljana 1995.