

IS BASIC CAPABILITY IMPORTANT ENOUGH TO DISTINGUISH BETWEEN GROUPS OF DIFFERENT COMPETITIVE PERFORMANCE LEVELS IN WILD-WATER SLALOM?

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ALI JE OŠNOVNA ZMOGLJIVOST KAJAKAŠEV V SLALOMU NA DIVJIH VODAH TAKO POMEMBNA, DA RAZLIKUJE SKUPINE Z RAZLIČNIM TEKMOVALNIM RANGOM?

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Abstract

The aim of the study was to test a hypothesis that paddlers in wild-water slalom, who reached a higher level of competitive performance (Olympic games level), also have a higher level of basic endurance and basic speed endurance performance than those who compete on lower levels. Four groups of four paddlers were tested: National Olympic team (OLYMPIC), a group of paddlers in the national team who failed to qualify for the Olympic games (NON-OLYMPIC), a group of national juniors group (JUNIOR A) and a group who failed to be selected to the national juniors group (JUNIOR B). All performed two tests: incremental paddling test on flat water for assessment of basic endurance performance and »8« test for assessment of basic speed endurance performance. The results showed that basic endurance characteristics: vLT , $vOBLA$ and $vmax$ and basic speed endurance characteristic $t8$ did not differentiate the OLYMPIC group (2.26 ± 0.02 m/s, 2.37 ± 0.05 m/s, 2.58 ± 0.07 m/s, 110.5 ± 7.1 s) from the NON-OLYMPIC (2.26 ± 0.07 m/s, 2.39 ± 0.08 m/s, 2.62 ± 0.04 m/s, 113.1 ± 1.6 s). The results showed that both groups were so close, according to results, that they practically represented a homogeneous single group. Significant differences occurred when the OLYMPIC group was compared to JUNIORS A (2.17 ± 0.06 m/s ($P < 0.05$), 2.27 ± 0.08 m/s, 2.47 ± 0.07 m/s, 121.2 ± 5.7 s), but only in vLT and JUNIORS B (2.07 ± 0.02 m/s ($P < 0.01$), 2.18 ± 0.09 m/s ($P < 0.01$), 2.37 ± 0.09 m/s ($P < 0.01$), 126.5 ± 3.5 s ($P < 0.01$)). When both seniors groups were combined into one SENIOR group, then the differences with each of the juniors groups became highly significant in all the parameters. Therefore, the hypothesis of the study was supported. When the differences between paddlers in competitive performance became substantial, then basic endurance and basic speed endurance performance followed suit.

Key words: wild-water slalom kayak, endurance, speed endurance

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Izvleček

Cilj raziskave je bil preizkus domneve, da se vrhunski kajakaši na divjih vodah v slalomu razlikujejo od tistih, ki tega nivoja ne dosegajo, tudi po osnovnih zmogljivostih: vzdržljivosti in hitrostni vzdržljivosti in ne le samo po tistih, ki kažejo specifično kajakaško zmogljivost. Sodelovale so štiri skupine s po štiri kajakaši: olimpijska ekipa (OLYMPIC), del nacionalne ekipe, ki se ni uvrstil v kvalifikacijah na Olimpijske igre (NON-OLYMPIC), del juniorske nacionalne ekipe (JUNIORS A) in del ekipe ki se ni uvrstila v nacionalno juniorsko ekipo (JUNIORS B). Vsi kajakaši so opravili dva testa: standardni test z enakomernim povečevanjem hitrosti veslanja za oceno osnovne vzdržljivosti in test »8« za oceno osnovne hitrostne vzdržljivosti. Rezultati kažejo, da so kazalci osnovne vzdržljivosti: vLT , $vOBLA$ in $vmax$ ter osnovne hitrostne vzdržljivosti $t8$ ne diferencirajo skupine OLYMPIC ($2,26 \pm 0,02$ m/s, $2,37 \pm 0,05$ m/s, $2,58 \pm 0,07$ m/s, $110,5 \pm 7,1$ s) od skupine NON-OLYMPIC ($2,26 \pm 0,07$ m/s, $2,39 \pm 0,08$ m/s, $2,62 \pm 0,04$ m/s, $113,1 \pm 1,6$ s). Rezultati kažejo takšno podobnost med skupinama, da ju ni mogoče ločiti, torej spadata k eni homogeni skupini. Statistično značilne razlike dobimo šele pri primerjavi OLYMPIC skupine z JUNIORS A ($2,17 \pm 0,06$ m/s ($P < 0,05$), $2,27 \pm 0,08$ m/s, $2,47 \pm 0,07$ m/s, $121,2 \pm 5,7$ s), toda le pri kazalcu vLT in skupini JUNIORS B ($2,07 \pm 0,02$ m/s ($P < 0,01$), $2,18 \pm 0,09$ m/s ($P < 0,01$), $2,37 \pm 0,09$ m/s ($P < 0,01$), $126,5 \pm 3,5$ s ($P < 0,01$)). Ko obe seniorski skupini združimo v eno SENIOR, se razlike z obema juniorskima skupinama izrazito povečajo pri vseh kazalcih. S tem je hipoteza naloge potrjena. Kadar obstajajo razlike v tekmovalni zmogljivosti kajakašev v slalomu na divjih vodah, potem se te razlike preslikavajo ne samo v specifičnih sposobnostih kajakašev temveč tudi v osnovni vzdržljivosti in osnovni hitrostni vzdržljivosti.

Ključne besede: kajak slalom na divjih vodah, vzdržljivost, hitrostna vzdržljivost

INTRODUCTION

Wild water slalom competition consisted of two runs of approximately 2 minutes duration of high intensity exercise. Such exercise was assessed to be dependent on about 50% energy coming from aerobic processes and about 50% from anaerobic (Astrand, & Rodahl, 1986). The endurance part of competitive performance is based on aerobic energy release. Anaerobic energy release is the background for speed endurance, which can be realised through the speed, strength and power of paddling. Both may be important basic competition performance characteristics. From the point of view of specific performances, the wild-water slalom competition is strongly dependent on technique and tactics (Vest, 1996). It may be assumed that different levels of basic performance of paddlers give them the possibility to compete on different levels of intensity. This optimal intensity permits the highest paddling velocity at which fatigue occurs as late as possible during the competition. If it is dependent also on basic competition performance characteristics, then better paddlers should have basic endurance and speed-endurance performances on a higher level than paddlers, who do not reach such high competition performance level. This permits them to compete with higher absolute velocity throughout the slalom course, and be similarly fatigued as paddlers who reached a lower level of competition performance and lower basic performance. If this hypothesis is correct then one may expect a significant difference in basic endurance and speed endurance characteristics of paddlers of different competition performance, in spite of their lower importance in relation to specific kayak slalom performances, technique and tactics. The aim of the study was therefore to ascertain if the differences in basic performance characteristics accompanied different competition performance level (quality) of wild water paddlers.

METHODS

The four groups of four paddlers (Table 1) recruited from the Slovenian national senior and junior teams with addition of one Italian athlete in the OLYMPIC group, participated in the study. The Olympic group (OLYMPIC) consisted of paddlers who competed at the Olympic games in Sydney (2000) and Atlanta (1996). The non-Olympic group (NON-OLYMPIC) consisted of paddlers who failed to qualify for the Olympic team. In spite of that, they compete on the highest international level. The national junior team members were included in the first juniors group (JUNIOR A) and the second junior group (JUNIOR B) consisted of juniors who failed to qualify for the national junior team.

All subjects participated in the test of incremental paddling velocity on flat water (Ušaj, 1998 a). They performed 5 repetitions on a 600 m distance with a constant pre-determined heart rate (HR). The paddling intensity was controlled to be constant according to constant HR. It increased from 110 b/min during the first 600 m repetition, to 130, 150, 165 and concluded in the final repetition with maximal possible intensity.

Of all the subjects, just one from the OLYMPIC group, failed to participate in the second test. This test of »eight« (»8«) simulated the competition effort on flat water (Ušaj, 1998b). There were two gates separated by a distance of 50m, which should be paddled in a figure of eight, with the maximal possible intensity.

During the incremental test, the time to complete each 600 m distance was measured in addition to HR measuring, which was also used to control the intensity of the effort. After each repetition, capillary ear lobe blood samples (10 μ l) were sampled and dissolved in LKM140 lactate solution and measured for lactate concentration with a MINI8 photometer (dr. Lange, Germany). A similar technique was also used for blood sampling after the »8« test, however with a delay of about 3 min. The [LA] and HR from the incremental test were plotted against paddling velocity for the determination of the Lactate Threshold (LT) (Beaver, Wasserman, & Whipp, 1985; Ušaj, 1990; Ušaj, 1998a), Onset of blood lactate accumulation (OBLA) (Karlsson, & Jacobs, 1982; Ušaj, 1998a) and maximal values. LT was described as velocity (v_{LT}), HR (HR_{LT}) and [LA] (LA_{LT}). OBLA was described as velocity (v_{OBLA}) and HR (HR_{OBLA}). Maximal intensity was described as velocity (v_{max}), HR (HR_{max}) and [LA] (LA_{max}). Additionally, the steeper slope of two regression lines in a diagram of $\log[LA]$ dependent to $\log(v)$ was used for calculating the rate of [LA] increase (LA_{rate}).

Using t-test, the significance of the differences between OLYMPIC and the other three groups were tested. The limit of 5 % significance was used.

RESULTS

The paddling velocity determined by LT (v_{LT}) reached similar values in OLYMPIC and NON-OLYMPIC groups (Table 1, Fig 1). The JUNIOR A group achieved a velocity about 0.09 m/s lower ($P < 0.05$) (Table 1, Fig. 1) and the JUNIOR B group about 0.19 m/s ($P < 0.01$) (Table 1, Fig. 1). The velocity v_{OBLA} reached similar values in OLYMPIC and NON-OLYMPIC groups (Table 1, Fig.1), similarly as for the JUNIOR A group, however close to the limit of significance ($P = 0.08$). There was only a tendency for lower intensity (Table 1, Fig. 1). Differently, the JUNIOR B group achieved a velocity about 0.14 m/s lower ($P < 0.01$)

(Table 1, Fig. 1). The maximal velocities in the incremental test (v_{max}) of NON-OLYMPIC and JUNIOR groups were not different from the OLYMPIC group (Table 1, Fig. 1) in spite of a tendency of lower values

($P=0.07$) in JUNIOR A. Only the JUNIOR B group showed about 0.27 m/s lower v_{max} ($P<0.01$) (Table 1, Fig. 1).

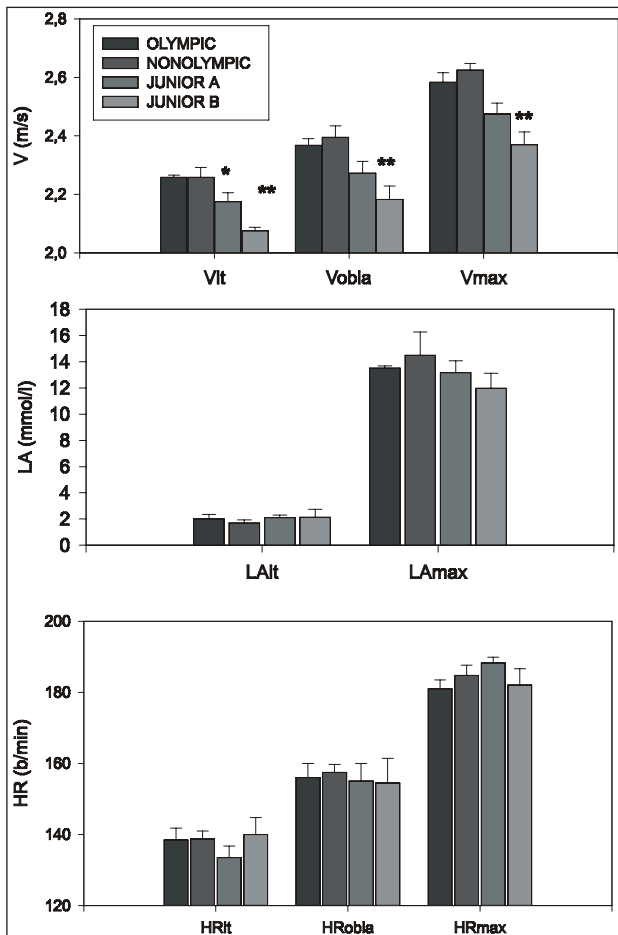


Fig. 1 Comparisons between velocities, [LA] and HR determined by criterions Lactate Threshold (lt), Onset of Blood Lactate Accumulation (obla) and maximal intensity (max) of four groups of subjects during incremental test. * - means different from OLYMPIC ($P<0.05$), ** - different from OLYMPIC ($P<0.01$).

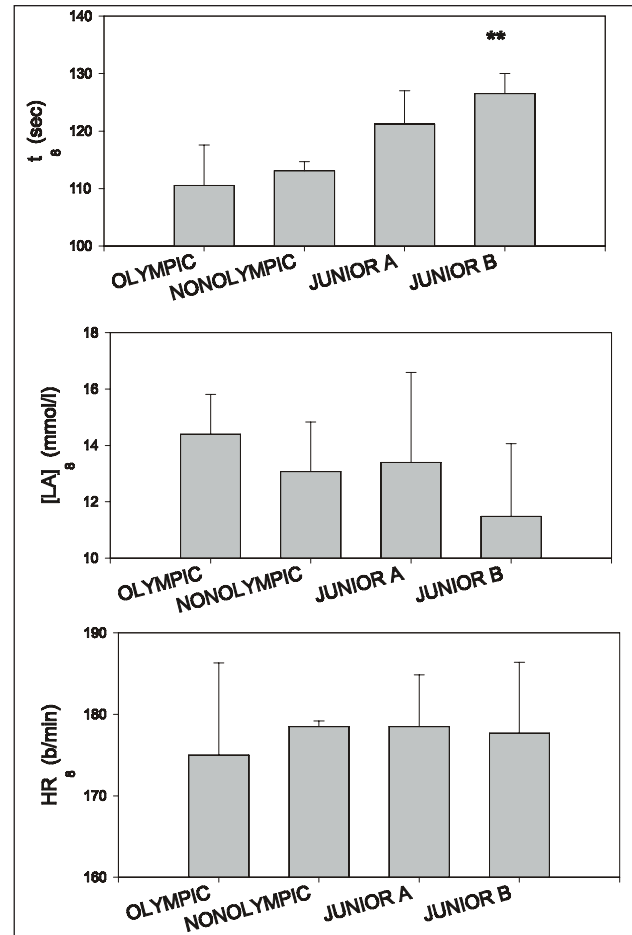


Fig. 2 Comparisons between velocities, [LA] and HR determined for four groups of subjects during »8« test. * - means different from OLYMPIC ($P<0.05$), ** - different from OLYMPIC ($P<0.01$). Note that only JUNIOR B was significantly different than OLYMPIC group.

Table 1 COMPARISONS BETWEEN FOUR GROUPS OF PADDLERS ACCORDING TO THEIR BASIC ENDURANCE PREPARATION CHARACTERISTICS

GROUP NAME	CHARACTERISTICS OF THE BASIC ENDURANCE PERFORMANCE								
	v_{LT} (m/s)	v_{OBLa} (m/s)	v_{max} (m/s)	LA_{LT} (mmol/l)	LA_{max} (mmol/l)	HR_{LT} (b/min)	HR_{OBLa} (b/min)	HR_{max} (b/min)	$\Delta LA/\Delta v$
OLYMPIC	2.26 (0.02)	2.37 (0.05)	2.58 (0.07)	2.0 (0.6)	13.5 (0.4)	138 (6)	156 (8)	181 (5)	15.77 (3.35)
NONOLYMPIC	2.26 (0.07)	2.39 (0.08)	2.62 (0.04)	1.7 (0.4)	14.5 (3.5)	139 (4)	157 (4)	185 (6)	14.53 (2.85)
JUNIORS A	2.17 (0.06) *	2.27 (0.08)	2.47 (0.07)	2.1 (0.4)	13.2 (1.8)	133 (7)	155 (10)	188 (3)	14.50 (2.14)
JUNIORS B	2.07 (0.02) **	2.18 (0.09)**	2.37 (0.09)**	2.10 (1.2)	12.0 (2.3)	140 (9)	154 (14)	182 (9)	13.04 (2.37)

LEGEND: For abbreviations see the text. * – different than OLYMPIC ($P<0.05$) ** – different than OLYMPIC ($P<0.01$)

Table 2
COMPARISONS BETWEEN FOUR GROUPS OF
PADDLERS ACCORDING TO THEIR BASIC SPEED
ENDURANCE PREPARATION CHARACTERISTICS

CHARACTERISTICS OF THE BASIC SPEED ENDURANCE PERFORMANCE			
GROUPNAME	t ₈ (s)	HR (b/min)	[LA] (mmol/l)
OLYMPIC	110,5 (7.1)	175 (11)	14,4 (1.4)
NONOLYMPIC	113.1 (1.6)	178 (1)	13.1 (1.7)
JUNIORS A	121.2 (5.7)	178 (6)	13.4 (3.2)
JUNIORS B	126.5 (3.5) **	178 (9)	11.5 (2.6)

LEGEND: For abbreviations see the text.

* - different than OLYMPIC (P<0.05)

** - different than OLYMPIC (P<0.01)

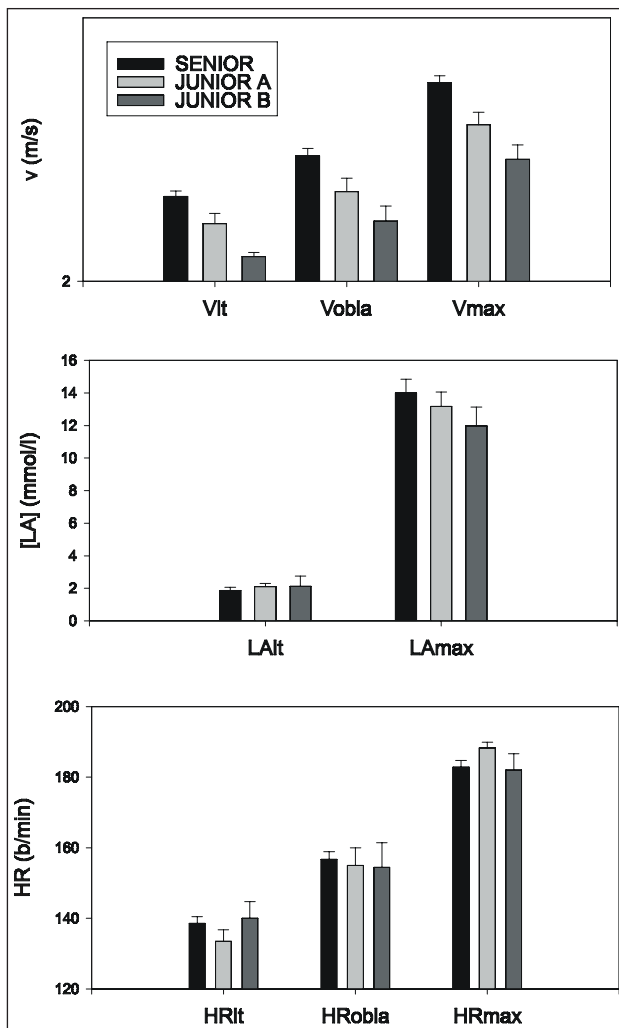


Fig. 3
Comparisons between velocities, [LA] and HR determined by
criteria Lactate Threshold (lt), Onset of Blood Lactate Accumu-
lation (obla) and maximal intensity (max) of four groups of sub-
jects during incremental test. * - means different from SENIOR
(P<0.05), ** - different from SENIOR (P<0.01).

[LA] determined by the criterion LT (LA_{LT}) and that determined at the end of the incremental test (v_{max}) did not show any significant differences between groups (Table 1, Fig. 1). Similarly, heart rate, determined by using different criteria, was also not different (Table 1, Fig. 1). The LA_{rate} in diagrams of log [LA]/log (v) also did not show any significant difference between groups (Table 1). The increase of HR during the incremental test (HR/v) did not show any significant differences between groups (Table 1).

The duration of paddling during the »8« test (t₈) did not differentiate between OLYMPIC and NON-OLYMPIC nor JUNIOR A groups, even if the JUNIOR A group showed a clear tendency for longer duration (Table 2, Fig. 2). This tendency increased for about 16 s in the JUNIOR B group (P<0.01) (Table 2, Fig. 2). In contrast, [LA] and HR did not show any significant differences between the OLYMPIC and the other groups (Table 2, Fig. 2).

All observed velocities showed very similar values for the OLYMPIC and NON-OLYMPIC groups. More precisely, analysis of subjects of both groups showed that maybe both groups were practically the same group. If both groups were combined into one group (SENIOR) then, v_{LT}, v_{OBLA} and v_{max} reached the following values: 2.26±0.05 m/s, 2.38±0.06 m/s, 2.60±0.06 m/s. Compared with the JUNIOR A and JUNIOR B groups, differences in all velocities v_{LT}, v_{OBLA} and v_{max} became significant (P<0.01) (Fig. 3). Additionally also t₈ (112.2±3.6 s) passed its significance (P<0.01). All other parameters used in the study did not show significant differences.

DISCUSSION

The main hypothesis of the study was that paddlers who reached a higher level of competition performance (OLYMPIC) also have higher basic endurance and basic speed endurance levels than those who did not reach such high competition performance. Our results support the assumption that a higher level of basic endurance and basic speed endurance performance makes possible a higher paddling speed during competition.

In our study two basic performances, basic endurance and basic speed endurance, were estimated by using Lactate Threshold, Onset of Blood Lactate Accumulation and maximal performance during an incremental test and by using characteristics of the »8« test (Ušaj, 1998a; Ušaj, 1998b). Results showed that basic endurance performance estimated by velocities v_{LT}, v_{OBLA} and v_{max} and basic speed endurance estimated by time reached in the »8« test differentiates between paddlers only if the difference in their competition performance is also substantial. There

was no difference between both groups of senior paddlers (OLYMPIC and NON-OLYMPIC). The selection, which separates them into one of two groups was based on ranking their competition results (competition time and penalty time) and not just on the differences between achieved competition times. The limit, which selects paddlers to the OLYMPIC group, was set at two best-ranked paddlers from the qualification competitions. It was declared by national Olympic Committee and may be unfair to the next one or more subjects who reached similar competition results, however, they have been ranked to places following the second because of the penalty time reached when mistakes were made. Grouping of all seniors into one group may therefore be better for a scientific analysis of differences between different groups of paddlers. Repeated analyses give a different result when only one joint SENIOR group was compared with JUNIOR A and JUNIOR B than in the case when only the OLYMPIC group was used in the analysis. The differences observed in all speeds and t8 supported the hypothesis that also basic endurance performance and basic speed endurance performance differentiate between paddlers similarly as do competition times. Paddlers, who reached a higher competition level, showed also a higher level of basic endurance and basic speed endurance performance. Additionally, their HR and LA response during the tests was similar in spite of a clear difference in the absolute intensity of paddling. Therefore, in addition to dominant specific paddling skills, also basic endurance and basic speed endurance seems to be very important in differentiating paddlers according to their competition performance. This conclusion has important practical application for wild-water slalom training. It showed that basic endurance and basic speed endurance performance have to receive enough attention during training also in competition periods

and not only during preparatory training periods. This is however in contrast to the training philosophy of a certain number of slalom paddlers and coaches. According to our results this philosophy should be changed.

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