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ORIGINAL RESEARCH

COMPARATIVE STUDY BETWEEN PERFORMING ON WATER AND RESULTS ON ERGS IN MEN'S ROWING

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Abstract

This study tries to prove the fact that a significant correlation could be identified between the results on ergs, expressed by some of the basic parameters, and the results on water, making possible an acceptable anticipation of the performances achieved in the competitions to come. The rowing is a cyclic sport whose specific movement can be learned on an ergo too, on which supplementary training sessions could be done during the pre-competitive session.

The study was conducted over a period of 11 months (January 15 to December 15, 2009) in the Juniors Olympic Centers of Năvodari and Călărași, during a pre-competitive and a competitive training period. Our research subjects are a group of 12 athletes from the two clubs: 6 athletes from Năvodari Sports Club and 6 athletes from Călărași Sports Club.

The study was made during the physical and technical training programs within the training period by land and on water, monitoring the evolution of the performance parameters statistically in men's rowing. The statistical processing was made in Word and "KyPlot" programs, nonparametric multiple comparisons, and the linear correlation.

As for the evolution of the performance parameters on ergometer applied during the junior rowers' technical and physical training programs, 6 tests were exemplified along the training period by land and on water, these ones including also the participation of 7 athletes in the Ergs National Championship 2000m.

The results achieved on ergometer rowing machines on 2000m, during the tests 1, 2 and 3, *representing the period of spring-winter*, there are time and power improvements, as for the analysis of the results obtained on ergometer rowing machines, 2000m, at tests no. 4, 5 and 6, *representing the winter period*, improvements of time and power are evident at tests 4 and 5 but there is a poorer performance at test no. 6.

The results of the study confirmed that the significance of the relationship between the competitive performance and the results on an ergometer rowing machine are not based on a causal relationship, but probably represents a common effect of the physical training level specific to the rowing.

Key words: rowing, ergometer, physical training, technical training.

Introduction

The sports training in rowing is a long-term systematic sports activity, progressively and individually graded (Bompa, 2002) and which is mainly based on continuously increasing physical and mental efforts, meant to provide functional and structural changes in athletes' bodies. (Dragnea et al., 2006).

The physical effort during competition events lasts about 6 minutes in men's case and about 6.30 in women's case (2000 m) and keeps within the group of average endurance sports (2–10 min) with an approximately equal demand (50% anaerobic + 50% aerobic). The peak demands are situated at cardiovascular, metabolic and neuromuscular levels. In terms of motor skills, the muscular endurance is combined with strength requirements. Other physiological issues concern the sense of balance in boat and the arms coordination (Dragnea, A. și Teodorescu- Mate, S., 2002). As for the rowing, we can speak about coordination skills specific to sweep rowing and sculling motion (Nicu A., 1993).

The assessment of the general physical training level, as an expression of the degree of development of each motor skill separately and jointly, is made by means of on-water and off-water control trials. (Urichianu-Toma, S., 2010).

The need to simulate and to use the ergometer rowing machine for athletes' training originates from the necessity to overcome some shortcomings occurred in the technology used in the training process. The ergs used in sports activity must answer the specific actions taken by athletes on water. The reconstruction of the environmental conditions provided by ergs should allow a rapid measurement of the parameters related to the

specific motion, enabling a correlation between the motion dynamics and kinematics recorded data (Urichianu-Toma, S., 2010).

The **purpose of the study** is the attempt to identify a significant correlation existing between the results on ergs expressed by some of the basic parameters and the results on water, allowing an acceptable estimate of the likely performances during the future competitions.

Study hypotheses

It is considered believe that there is a positive and significant correlation between results on ergs and results on water, conditioned by the time elapsed between records, the rower's individual behavior in the shell (single or crew), the emotions or other mental factors, the quality of materials, etc.

It is considered that the significance of the relationship between competitive performance and results on ergs is not based on a causal relationship, but is probably a common effect of the physical training level specific to the rowing. In other words, the training form level, such as the mental one, in which the volitional skills and the emotions control skills may influence both performances mentioned above.

Organization and conduct of the study

The study was conducted over a period of 11 months (January 15 to December 15, 2009) in the Juniors Olympic Centers of Năvodari and Călărași.

The study was carried out during a pre-competitive and competitive training period. The *subjects* of our research represent a group of 12 male athletes belonging to the two clubs: 6 male athletes from Năvodari Sports Club and 6 male athletes from Călărași Sports Club.

The athletes are juniors (17-18 years old) with an intensive training for three years; they trained under a training camp program, Monday through Friday, with 2 rowing sessions (outdoors or indoors) and a strength training session or a running one. On Saturday they had a rowing training session and a running and on Sunday they had a rowing training session.

Methods

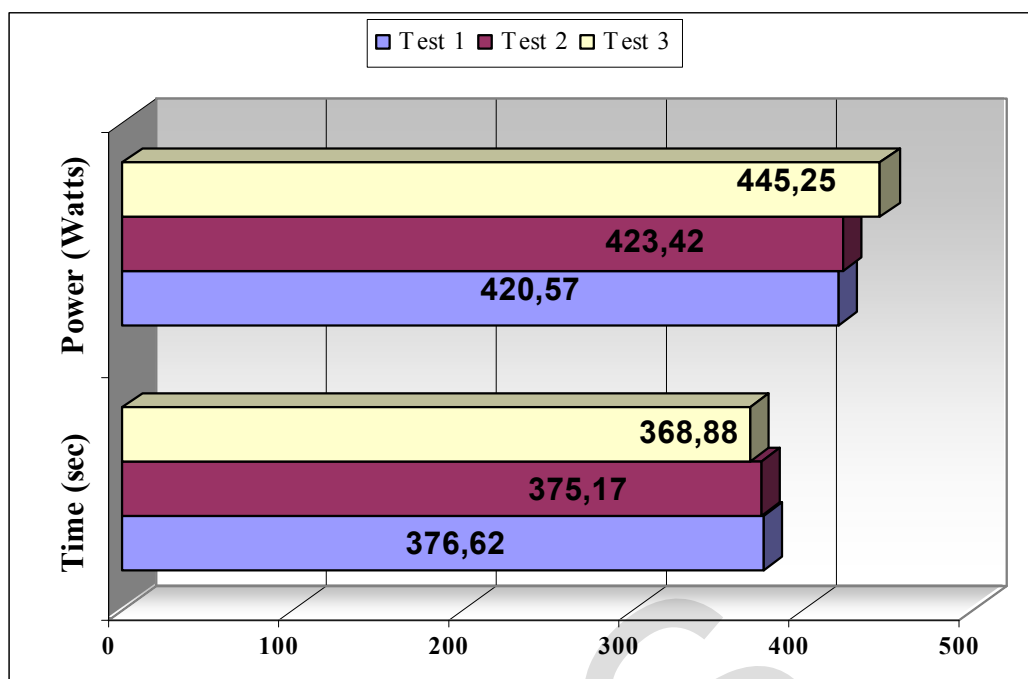
The study was made during the physical and technical training programs within the training period by land and on water, monitoring the evolution of the performance parameters statistically. The statistical processing was made in Word and "KyPlot" programs, nonparametric multiple comparisons, Steel- Dwess test and the linear correlation.

Results of the study

Table no.1. Results obtained on ergs

	Ergometer – 2000 m						National Championship-Ergometer - 2000m, Men Open, 19.02.2009		
	Test 1			Test 2			Test 3		
Full name	Time T1	Transf. Sec T1	Power Watts T1	Time T2	Transf. sec T2	Power Watts 2	Time T3	Transf. sec. T3	Power Watts T3
P.V.	6:10.00	370.0	442	6:17.00	377.0	418	06:01.5	361.5	474.2
M.G.	6:08.08	376.08	447	6:07.04	367.04	452	06:07.0	367.0	453.1
O.M.	6:18.08	378.08	412	6:15.08	375.08	422	06:09.4	369.4	443.3
G.R.	6:19.04	379.04	400	6:14.00	374.0	428	06:09.5	369.5	443.8
S.G.	6:20.06	380.06	406	6:18.02	378.02	414	06:10.5	370.5	440.3
F.D.	6:17.04	377.04	417	6:19.09	379.09	409	06:11.0	371.0	438.6
D.M.	6:16.04	376.04	420	6:16.02	376.02	421	06:13.3	373.3	430.5
Test Multiple comparisons									
Mean		376.62	420.57		375.17	423.42		368.88	445.25
Transf. Sec T1			-3.13 (P<0.05)		1.08 NS (P>0.05)	-3.13 (P<0.05)		2.74 NS (P>0.05)	-3.13 (P<0.05)
Power Watts T1		0.021			3.13 (P<0.05)	0.83 NS (P>0.05)		3.13 (P<=0.05)	-2.108 NS (P>0.05)
Transf. sec T2		0.887	0.021			-3.13 (P<0.05)		2.49 NS (P>0.05)	-3.13 (P<0.05)
Power Watts 2		0.021	0.96		0.021			3.13 (P<=0.05)	2.49 NS (P>0.05)
Transf. sec. T3		0.066	0.021		0.128	0.021			-3.13 (P<0.05)
Power Watts T3		0.021	0.28		0.021	0.128		0.021	

Note: T1- test 1, T2- test 2, T3 – test 3, Transf.- transformation of minutes into seconds



Graph no.1. Results of the means achieved on ergs

In table no.1 and graph no.1 are shown the times recorded on a distance of 2000m on the ergometer rowing machine, the power expressed in watts on the same distance, the transformations of the time from minutes into seconds and the results achieved by the athletes during the Men's National Championship and the multiple comparison through the non-parametric test „KyPlot” .

Table no. 2. Results achieved during rowing

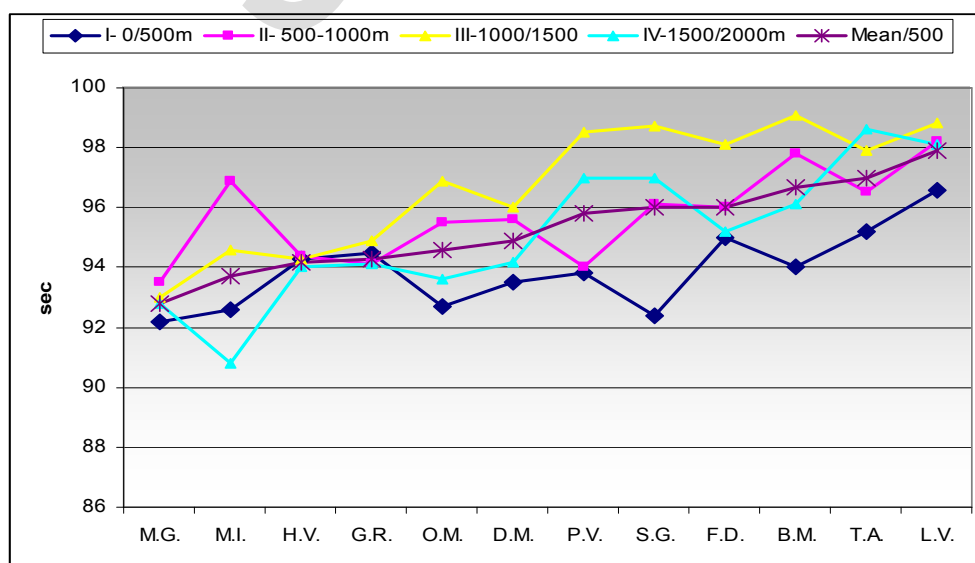
	Lane R1 2000m water		Lane R2 1x2000m pace 26	
	22/04/2009		29/04/2009	
	Final time (min)	Transf. sec.	Final time (min)	Transf. sec.
Mean		451.28		467.18
SEM		2.13		2.57
S.D.		7.36		8.92
Coef. Var.		1.63		1.91
R –correlation coef.	0.863			
T - Statistic	5.4203			
P- Value	0.00029			

In table no. 2 are listed the times recorded on the lane of 2000m under calm water conditions or as we (the rowers) say “flat calm” conditions, regarding the subjects’ performances on Lane R1 2000m water and Lane R2 1x2000m pace of 26 strokes/min and the linear correlation between „KyPlot“ tests.

Table no.3 Results achieved on ergometer 2000 m

		Test 4- Ergometer 2000 m - R1			Test 5 Ergometer 2000m 02.12.2009			Test 6 - Ergometer 2000m 11.12.2009		
		Time	Transf	Watts	Time	Transf.	Watts	Time	Transf.	Watts
1	M.G.	06:11.5	371.5	437	6:08:08	368.08	446.6	6:10:09	370.09	439.0
2	M.I.	06:14.9	374.9	425	6:10:05	370.05	440.4	6:12:05	372.05	433.5
3	H.V.	06:16.9	376.9	418	6:10:05	370.05	440.0	6:14:04	374.04	426.9
4	G.R.	06:17.5	377.5	416	6:11:03	371.03	437.5	6:15:01	375.01	424.0
5	O.M.	06:18.6	378.6	413	6:13:01	373.01	431.4	6:15:04	375.04	423.0
6	D.M.	06:19.7	379.7	409	6:13:01	373.01	431.3	6:15:09	375.09	421.8
7	P.V.	06:23.3	383.3	498	6:13:08	373.08	429.0	6:18:09	378.09	412.0
8	S.G.	06:24.0	384.0	396	6:15:03	375.03	423.9	6:19:06	379.06	409.0
9	F.D.	06:24.3	384.3	395	6:15:05	375.05	423.0	6:24:04	384.04	394.3
10	B.M.	06:26.9	386.9	387	6:17:01	377.01	417.0	6:26:00	386.00	389.0
11	T.A.	06:28.2	388.2	383	6:17:06	377.06	416.0	6:26:04	386.04	388.0
12	L.V.	06:31.7	391.7	373	6:28:03	388.03	382.6	6:29:01	389.01	380.2
Mean			381.5	412.5		374.2	426.56		378.63	411.725
SEM			1.71	9.44		1.49	4.84		1.78	5.64
S.D.			5.93	32.72		5.17	16.7		6.19	19.56
Coef. Var.			1.55	7.93		1.38	3.93		1.63	4.75
Multiple comparisons										
Test 4 - Ergometer 2000m - R1 (Transf.)				-.305 P<0.05		2.83 NS(P>0.05)	-3.81 P<0.01		1.039 NS(P>0.05)	-3.637 P<0.01
Test 4 - (Watts)		0.026				3.581 P<0.01	-2.107 NS(P>0.05)		3.291 P<0.05	-0.433 NS(P>0.05)
Test 5 Ergometer 2000m (Transf)		0.052	0.004				-4.101 P<=0.001		-1.906 NS(P>0.05)	-4.043 P<=0.001
Test 5 - (Watts)		0.001	0.283			0.0005			3.925 P<=0.01	1.934 NS(P>0.05)
Test 6 - Ergometer 2000m (Transf.)		0.904	0.012			0.398	0.001			-3.8105 P<0.01
Test 6 - (Watts)		0.003	0.99			0.0007	0.381		0.001	

In table 3 are introduced the times recorded on a distance of 2000m on RA ergometer, the power expressed in watts on the same distance and the transformations of the time from minutes into seconds at Testing 4, 5 and 6 and the multiple comparison between tests by means of the „KyPlot” nonparametric test.



Graph no.3. Subjects' evolution on ergo R1- 2000 m

In graph 3 are listed the subjects' times on ergometer R1- 2000m., highlighting the statistical calculations at the 4 segments of the 2000m course lane, the total time to cover and the rowing power.

Discussions

In the literature there are studies on the relationship between outcome and the ergometer sport on water. The present study argues that between ergometer results, expressed by some basic parameters, and results of the water may find a significant correlation, allowing an acceptable predictive performance of the tournament ahead.

As for the evolution of the performance parameters on ergometer applied during the junior rowers' technical and physical training programs, 6 tests were exemplified along the training period by land and on water, these ones including also the participation of 7 athletes in the Ergs National Championship 2000m.

The results achieved on ergometer rowing machines on 2000m, during the tests 1, 2 and 3, *representing the period of spring-winter*, point out that the average value of the time in seconds at test no. 1 is 376.62 and the power average value is 420.57 watts; at test no. 2, the average time in seconds is 375.17 and the average power is 423.42 watts, and at the test no. 3, the average time in seconds is 368.88 and the average power is 445.25 watts. As for the subjects' performances at each test, there are time and power improvements; regarding the multiple correlation of the tests and the effort power there are insignificant differences between the tests times at $P>0.05$ and significant differences between the times and the effort power at $P<0.05$.

Analyzing the results obtained at rowing on lane R1- 2000m and on lane R2-2000m, a time improvement by 15.9 sec. was noticed as well as a significant correlation between tests at $p=0.01$.

The analysis of the results obtained on ergometer rowing machines, 2000m, at tests no. 4, 5 and 6, *representing the winter period*, highlights the fact that, at test no. 4, the mean of the time in seconds is 381.5 and the average value of the power is 412.5 watts; at test no. 5, the average time in seconds is 374.2 and the average power is 426.56 watts, while at test no. 6 the average time in seconds is 378.63 and the average power is 411.725 watts. Regarding the performances of the subjects at each testing, improvements of time and power are evident at tests 4 and 5 but there is a poorer performance at test no. 6; as for the multiple correlation between tests and effort power, there are *insignificant differences between the tests times* at $P>0.05$ and *significant differences between times and effort power* at $P<0.05$ and $P<0.01$.

The results obtained on ergometer rowing machine 2000m R1 point out the times achieved on ergo on each segment of 500m in the race of 2000m, the average time on 500m in the 2000m race, the average power developed on 2000m expressed in watts; we mention that this lane of 2000m on ergometer rowing machine is the first one in the annual cycle 2009 and we cannot claim a spectacular performance.

The tables presented above show that the ergo proves better the athlete's individual performance than the shell. Also, as mentioned in the previous conclusion, when the performance level on ergo, as general mean of the group, is high, the on-water performance level of the same group is high too.

Conclusions

The use of the ergometer rowing machine creates a new dimension for the training sessions, broadening their scope by extending the periods of specific training (rowing), with some repercussions on the results achieved in competitions.

The research found out that there is a positive and significant correlation between the results on ergo and the results on water, conditioned by the time period between records, the rower's individual behavior in the shell (single or crew), the emotions or other mental factors, the quality of materials, etc.

It was also confirmed that the significance of the relationship between competitive performance and results on ergs is not based on a causal relationship, but is probably a common effect of the physical training level specific to the rowing

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