

Influence of the maximum force indicators on the efficiency of passing the distance in academic rowing

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Abstract:

In modern sport, achievement of good results can only be justified in the well-founded scientific approach to build a training process. Aim: to determine the relationship between the indicators of the maximum strength of the rowers and the efficiency of passing the distance in academic rowing. Materials and methods: the research was conducted on the basis of Kherson School of Higher Sporting Skill. Fifteen academic rowers participated in the experimental part. All participants of the research had high sports qualification: Candidate for Masters of Sports (CMS), Master of Sports (MS), Master of Sports of the International Class (MSIC) and Honored Master of Sports (HMS). Methods of studying strength and functional readiness included the testing of the physical qualities of high sports qualification academic rowers, namely: pull the barbell with the hands lying down, the maximum acceleration on the paddle ergometer 'Concept-2' 'Dyba', horizontal traction in the block simulator (full amplitude) and the control test on the 'Concept-2' rowing simulator on a sports distance of 2000 m. Results: during the research, a significant correlation link between the sporting result (rowing 2000 m) and the indicator of 'maximum acceleration on the paddle 'Concept-2' simulator was determined, where $r=0,754$, testifying the effect of this indicator on the efficiency of passing the distance in academic rowing. The correlation link between the maximum acceleration on the paddle ergometer and the force tests have been established experimentally: the traction of the lying down ($r = - 0,643$) and the traction on the 'Dyba' ($r = - 0,844$). Conclusions: during the planning of training work, trainers need to pay significant attention to the development of strength endurance, but also they must take into account the close relationship between the time of passage of the distance and the indicators of maximum strength of athletes. Only due to the rational planning of training loads it is possible to achieve maximum results in competitions of the highest level.

Keywords: strength, functional readiness, simulators, training, correlation.

Introduction

The current level of sports results growth on the Ukrainian and international arenas requires constant search for ways to improve and streamline the training process, as well as to find the means and methods that fill it (Bakayev, Bolotin, & Chunguang You, 2018; Bolotin, & Bakayev, 2017; Gavrilova, Shelkov, Churganov, & Matochkina, 2015). The preparation of rowers who can adequately represent the country on the international arena and compete with the leading teams is impossible without a deep and comprehensive scientific basis of the physical training system (Platonov, 2018; Bolotin, & Bakayev, 2017; Huzar, 2001a). At the present stage the athletes training system has been enriched by considerable number of scientific researches that were devoted to the problem of raising the level of athletes physical fitness in academic rowing, where the authors state that the physical training, both general and special, is an integral part of the athletes sports improvement process and provides the base for competitive activities (Huzar, 2019; Dyachenko, 2004; Huzar, & Gavrilenko, 2001).

Several authors have contributed to the construction and planning of sports training for academic rowers (Diachenko, 2010; Kropta, 2004; Huzar, 2000a).

Our previous researches were aimed at identifying psychophysiological (Shalar, Pipaieva, & Strykalenko, 2017; Pipaieva, Shalar, & Strykalenko, 2015), psychical (Shalar, Strykalenko, & Petrukhina, 2010) and volitional (Shalar, Izhytskyy, & Zemlyakov, 2011) features and properties of the academic rowers and canoe rowers.

At the same time, in the last decade there is a lag behind Ukrainian academic rowers from the world elite, which is associated with an inefficient management system and a multi-year training methodology, in particular, with the content and methods of training at the stages of the sporting skills formation, the complex of meaningful physical qualities formation for sport effectiveness.

The development of special strength qualities is essential for the training process of academic rowers (Lewandowski, Piekorz, Biernat, Bukowska, Radzimińska, & Zukow, 2017; Zukow, Kozyrevm, & Gozhenko, 2017; Pavlyk, 2003), but this fact insufficient attention is paid. Therefore, it is very relevant to research the effect of special force on the competitive result of the rowers. The **research aim** is to determine the relationship between the indicators of the maximum strength of the rowers and the efficiency of passing the distance in academic rowing.

Materials and Methods

The researches were conducted on the basis of Kherson School of Higher Sporting Skill. Fifteen academic rowers participated in the experimental part and their personal data are given in Table 1. All participants of the research have high sports qualification: Candidate for Masters of Sports (CMS), Master of Sports (MS), Master of Sports of the International Class (MSIC) and Honored Master of Sports (HMS).

Table 1. Characteristics of the research contingent

No	Athlete's name	Year of birth	Rank	Best result	City of residence
1	Artem M.	1984	MSIC	8 place Olympic Games	Dnipro
2	Dmytro P.	1982	HMS	2 place World Championship	Mykolaiv
3	Dmytro H.	1995	MS	6 place World Championship U-23	Kherson
4	Oleksiy S.	1997	MS	4 place European Championship U-23	Kherson
5	Vitaliy Ts.	1989	MSIC	2 place World Universiade	Kherson
6	Maksym R.	1995	MS	1 place Ukrainian Championship	Kyiv
7	Maksym B.	1993	MS	9 place World Championship	Kherson
8	Anton B.	1992	MSIC	1 place World Championship U-23	Mykolaiv
9	Anton Kh.	1986	HMS	8 place Olympic Games	Mykolaiv
10	Artem M.	1980	HMS	1 place World Championship 6 place Olympic Games	Kherson
11	Dmytro M.	1990	HMS	1 place World Championship 6 place Olympic Games	Kherson
12	Serhii B.	1982	MSIC	2 place European Championship	Kherson
13	Artem V.	1992	MS	1 place World Championship U-23	Kherson
14	Vladyslav B.	1995	MS	9 place World Championship	Kherson
15	Serhii S.	1998	CMS	4 place European Championship U-23	Kherson

Note: HMS (Honored Master of Sports), MSIC (Master of Sports of the International Class), MS (Master of Sports), CMS (Candidate for Master of Sports).

The research was conducted in stages. Each of the stages solved specific tasks and had its own peculiarities.

1st stage. During the first stage (September-October 2017), the research was tasked with: determining the relevance of the subject and subject of research, research methods and contingent. At this stage, work was carried out with library catalogs, reference publications, analysis of scientific and methodological literature, and the methods of research were developed. This allowed formulating the aim and tasks, to develop of a research work programme.

2nd stage. During the second stage (October-December 2017) was conducted a practical part of the research: testing, pedagogical observation. A test was conducted to determine the maximum strength and physical fitness of the academic rowers.

3rd stage. During the third stage (January-February 2018), processing of results was carried out, systematized the research materials, carried out a mathematical analysis of the results, formulated conclusions.

Methods of studying strength and functional readiness included the testing of the physical qualities of high sports qualification academic rowers, namely: pull the barbell with the hands lying down, the maximum acceleration on the paddle ergometer 'Concept-2' 'Dyba', horizontal traction in the block simulator (full amplitude) and the control test on the 'Concept-2' rowing simulator on a sports distance of 2000 m.

Results

During the research, we evaluated and determined the indicators of maximum strength of academic athletes and the indicator of functional readiness through special control tests.

Methods of studying strength and functional readiness included the testing of the physical qualities of high sports qualification academic rowers, namely: pull the barbell with the hands lying down, horizontal traction in the block simulator 'Dyba' and the control test on the 'Concept-2' rowing simulator on a sports distance of 2000 m and also the maximum acceleration on the paddle ergometer 'Concept-2'. The results of all tests are presented in Table 2.

Analyzing the results, we note that the average maximum strength of the back muscles of the 'Horizontal traction' test in the group was 186 kg, the maximum strength of the upper shoulder belt of the 'Pull lying down' test was 112.3 kg and the maximum acceleration of 500 meters on the paddle ergometer 'Concept-2' was 1:06,7 min.

However, during the research, it was found that the results of the rowers are rather heterogeneous and fluctuate in certain limits: according to the test 'Horizontal traction' from 210 kg (MSIC Anton B.) to 165 kg (MS Oleksiy S.), according to the test 'Pull the barbell lying down' from 125 kg (MSIC Anton B. and HMS Dmytro M.) to 100 kg (CMS Serhii S. and MS Vladyslav B.). The obtained results confirm the data on the fact that with the increase in the level of athletic skill of the rowers and indicators of strength readiness.

A similar tendency is observed when analyzing the results of maximum acceleration on the paddle ergometer 'Concept-2' - the maximum results were obtained by HMS Dmytro P. and Anton B. (1:03.0 min.), and the lowest ones were done by MS Oleksiy S. (1: 10.0 min.).

Analyzing the indicators of strength abilities of academic rowers is found that according to the standards of Ukrainian national team on physical training, most athletes have shown relatively high rates of power training.

Table 2. Indicators of academic rowers' strength readiness

№	Name and surname	Tests			
		Dyba, kg	Horizontal traction, kg	Maximum acceleration on Concept-2 Result, min.	Time in seconds
1	Artem M.	200	110	1:05.0	65
2	Dmytro P.	200	120	1:03.0	63
3	Dmytro H.	180	115	1:06.0	66
4	Oleksiy S.	165	105	1:10.0	70
5	Vitaliy Ts.	170	120	1:08.0	68
6	Maksym R.	180	100	1:08.0	68
7	Maksym B.	190	110	1:07.0	67
8	Anton B.	210	125	1:03.0	63
9	Anton Kh.	175	105	1:08.0	68
10	Artem M.	190	120	1:07.0	67
11	Dmytro M.	190	125	1:05.0	65
12	Serhii B.	195	115	1:07.0	67
13	Artem V.	190	115	1:08.0	68
14	Vladyslav B.	180	100	1:07.0	67
15	Serhii S.	175	100	1:09.0	69
Average indicator		186	112,3	1:06,7	66,7

To study the functional training of high sports qualification academic rowers, we have applied a control test on the paddle ergometer 'Concept-2' on a sports distance of 2000 m. The best time recorded at the maximum pass 2000 m in model conditions of competitive activity. The results of this test are shown in Table 3.

Table 3. Indicators of academic rowers' functional readiness

№	Name and surname	Rowing 2000 m at Concept-2	
		Result, min.	Time in seconds
1	Artem M.	6:04,6	364,6
2	Dmytro P.	5:52,3	352,3
3	Dmytro H.	5:59,2	359,2
4	Oleksiy S.	6:16,0	376
5	Vitaliy Ts.	6:08,4	368,4
6	Maksym R.	5:59,3	359,3
7	Maksym B.	5:59,7	359,7
8	Anton B.	5:49,2	349,2
9	Anton Kh.	6:02,9	362,9
10	Artem M.	5:55,6	355,6
11	Dmytro M.	5:57,1	357,1
12	Serhii B.	5:58,1	358,1
13	Artem V.	5:59,5	359,5
14	Vladyslav B.	6:09,9	369,9
15	Serhii S.	6:18,1	378,1
Average indicator		6:01,9	361,9

The analysis of this test results showed that the following average indicator was 6:01,9 min. The best result on a distance of 2000 m was demonstrated by MSIC Anton B. - 5:49,2 min. The worst result had CMS Serheii S. - 6:29,6 min. Regarding the model characteristics of passing the distance on 'Concept-2' we note that most athletes showed the most approximate result. The results obtained during the research indicate that the level of rowers' functional readiness is on the sufficient level at this stage of training.

Summing up the indicators of academic rowers' strength and functional readiness, we note that special training in academic rowing is very relevant direction now. The use of special training equipment by rowers during the training process has a certain advantage over standard techniques and due to it is possible to achieve maximum changes in the indicators of strength and functional readiness at different stages of preparation.

The correlation between academic rowers' physical and functional indicators was determined for revealing of interconnections between the maximum strength indicators and the efficiency of passing the distance in academic rowing, which makes it possible to determine the suitability of using the exercises with their development in the training process.

According to the results of the correlation analysis, the results of 4 tests were analyzed, which allowed establishing a certain interconnection, which in the future would allow to rationalize the selection of the training process and increase the level of cumulative and discarded effects from the training lessons. The results of the correlation analysis are presented in Table 4.

Table 4. Correlation interrelation between the indicators of maximum force and the efficiency of passing the distance in academic rowing

Strength indicators	Functional indicators		
	Rowing 2000 m on Concept-2	Maximum acceleration	indicator on 'Concept-2'
Lying down traction	$r = -0,689$	$r = -0,643$	
Traction 'Dyba'	$r = -0,778$	$r = -0,844$	
Maximum acceleration indicator on 'Concept-2'	$r = 0,754$	-	

In the course of the correlation analysis of the obtained results it was established that there is a certain interconnection between the sports result of the control test on the rowing simulator Concept-2 at a sports distance of 2000 m and the indicators of the maximum strength of the academic rowers.

Analyzing the results of the research, it was found that a significant correlation exists between the 2000m rowing result and the Concept-2 maximum acceleration ($r = 0,754$). The reciprocal correlation dependence is determined between the passage of a 2000 m distance on an ergometer and the indicators of the traction test lying down ($r = -0,689$). Also, the reverse high correlation dependence is observed between the 2000m rowing indicators and the results of the traction on a 'Dyba' test ($r = -0,778$). In the course of research, a correlation relationship was also established experimentally between the maximum acceleration on the paddle ergometer and force tests (traction lying down ($r = -0,643$) and traction on the 'Dyba' ($r = -0,844$)).

A negative correlation coefficient means the presence of an opposite connection: the higher the value of one variable, the lower the value of another. So the negative correlation means that with the increase of one value the second tends to decrease. Thus, we can assume that the high rates development of maximum force can indicate high results when passing the 2000 m distance on the paddle simulator 'Concept-2', because less time we overcome the distance, the higher result is in the competition.

Discussion

The strength of the rower is directly realized through muscular effort, which creates forces acting on the paddle and the boat. Various strength abilities of the rower can be appeared in different ways of his specific activity. The practice shows that academic rowers need to work on the development of their maximum strength, because raising the level of maximum strength can more effectively influence on the performance of athletes (Kropta, 2004; Huzar, 2001b; Huzar, 2000b).

The specificity of the academic rowing determines the peculiarities of computing the competitive result. During the competition, the athlete performs his efforts with maximum strength repeatedly with a short-term manifestation. Without the manifestation of maximum strength, it is almost impossible to row powerfully, and accordingly, to give the maximum speed of the boat (Piekors, Danielski, Strojek, Molski, Zukow, & Lewandowski, 2018; Zhanneta K., Irina S., Tatyana B., Olena R., Olena L., & Anna I. 2015; Andrusyk, 1999). However, in modern academic rowing, the length of the passage of the distance is about 6-7 minutes, but it requires the maximum strength and endurance from an athlete. So coaches need to take into account the indicators of maximum strength and focus on the close combination of it with indicators of strength endurance during the training process.

Conclusions

In the course of the research, a significant correlation between the sporting result (2000 m rowing) and the indicator of the test 'Maximum acceleration on the paddle simulator Concept-2' was determined, which was $r = 0,754$, indicating the effect of this indicator on the effectiveness of passing the distance in the academic rowing. The reciprocal correlation dependence is determined between the indicators of 2000 m distance on the ergometer and the results of the strength tests: the maximum traction lying down ($r = - 0,689$) and the maximum traction on the 'Dyba' ($r = - 0,778$). The correlation relationship between the maximum acceleration on the paddle ergometer, force tests (traction lying down ($r = - 0,643$) and traction on the 'Dyba' ($r = - 0,844$) was established experimentally.

The obtained results proved that during the planning of training work coaches should pay considerable attention to the development of strength endurance, but also they should take into account the close relationship between the time of passing the distance and the indicators of maximum strength of athletes. Only due to the rational planning of training loads athletes can achieve maximum results in competitions of the highest level.

It has been proved experimentally that the indicators of maximum force influence on the efficiency of passing the distance in academic rowing.

One of a *promising direction* for further researches is the study of the influence of academic rowing classes on the development of functional body systems at different stages of the athletes' training and also the study of anthropometric indicators and rowing styles of world leading rowers for recent years.

Conflict of interests. The authors note that there is no conflict of interests.

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