Ovidius University Annals, Series Physical Education and Sport / SCIENCE, MOVEMENT AND HEALTH
Vol. XXIV, ISSUE 2 Supplement, 2024, Romania
The journal is indexed in: ERIH PLUS, Ebsco, SPORTDiscus, INDEX COPERNICUS JOURNAL MASTER LIST, DOAJ DIRECTORY OF OPEN ACCES JOURNALS, Caby, Gale Cengage Learning, Cabell's Directories

Science, Movement and Health, Vol. XXIV, ISSUE 2 Supplement, 2024
September 2024, 24 (2): 216-222
Original article

THE ROLE OF FUNCTIONAL CAPACITY IN TRAINING ATHLETES FROM THE NAVAL PENTATHLON SEAMANSHIP RACE

ABRAMIUC ALEXANDRU[1], ENE VOICULESCU CARMEN[1], ENE VOICULESCU VIRGIL[2], MIHAYLOVA MILEVA[3]

Abstract

Aim. In the naval pentathlon, an increase in current sports performances up to close to the physiological limits of the human body requires a change in activity at the level of the main structural elements, namely training and competition.

Methods. From this perspective, with the help of the means and methods applied at the naval pentathlon team level, we obtained an exponential development in functional capacity, which was reflected in the final results of the athletes engaged in the seamanship event.

Results. In the study conducted, the application of the tests, which investigates the functional capacity, demonstrated that from a statistical point of view, for the experimental group, the mean values became significant at the final test for vital capacity (at n-1; p=0.05) and respiratory frequency. This significant difference for the experimental group was the result of implementing the content of the training program of the structures of specific means, optimally dosed, specific to the seafaring skills test.

Conclusions. Thus, through the program developed and applied at the level of the sportsmen of the naval pentathlon team, significantly increased results were obtained at the level of the indices of the respiratory system: respiratory rate; apnea time; vital capacity; and of the cardiovascular system: the heart rate, a fact that determined a global increase in their performance at every single moment of the seamanship race.

Keywords: functional capacity, pentathlon, seamanship.

Introduction

In the naval pentathlon, an increase in current sports performances up to close to the physiological limits of the human body requires a change in activity at the level of the main structural elements, namely training and competition. From this perspective, the functional, motor, and mental demands of naval pentathlon determine performance capacity. Capacity "is a multifactorial outcome determined by skills, the degree of personality maturation, learning and exercise that can be educated through exercise" (Teodorescu, 2009). Inield of sports in the naval pentathlon "is not reduced only to solving to some standard situations but, most of the time, it refers to solving varied, unique situations through restructuring and recombining behaviors" (Teodorescu, 2009), depending on the typology of the effort from the five samples. Bota C. (2000), states that "the body's adaptive reactions, induced by the effort provided in training, are the basis of the increase in effort capacity, a component of the performance capacity on which the remarkable progress of current sports depends". The studies undertaken state that "in order for an athlete to reach such an ability to train, he must gradually and systematically go through all the stages of sports training, forming his ability to train through a thorough, thorough, and responsible preparation during training basic and construction" (Olbrecht, 2000).

The results of scientific research, respectively, on the evolution of sports performances led a series of authors to establish the existence of a limitation of effort capacity, in the sense that it "does not result from the summation of the functional capacity of all organs and systems, being limited by those organs which, reaching the maximum value of the functional capacity, prevents the intensification of the effort or its continuation although other organs and systems would allow this" (Dragnea & Teodorescu, 2002).

In the context of these theoretical aspects, Drăgan I. defines "exertion capacity, a particularly significant component of sports performance, which represents the possibility of the muscular system to release, through anaerobic glycolysis or oxidative phosphorylation, the energy required to produce the greatest possible mechanical work and maintain it for as long as possible" (Drăgan, 2002).

Methods

Functional capacity testing is determined by evaluating the following indices: respiratory rate, which is measured in breaths/minute; average values at rest ranging from 12 to 18 breaths/minute; and apnea time measured in seconds. Apnea, defined as "absence of spontaneous breathing" (http://medical-dictionary.thefreedictionary.com/apnea), is important in

[1] The Department of Physical Education, Sports and Physical Therapy, Faculty of Physical Education and Sport, Ovidius University of Constanta, 900470 Constanta, Romania; Corresponding author: alexandru_abramiuc@yahoo.com;
[2] Naval Tactics and Armament Department, Faculty of Marine Engineering, Mircea cel Batran Naval Academy, 900218 Constanta, Romania;
[3] National Sports Academy Vassil Levsky, Sofia, Bulgary.

Ovidius University Annals, Series Physical Education and Sport / SCIENCE, MOVEMENT AND HEALTH
Vol. XXIV, ISSUE 2 Supplement, 2024, Romania
The journal is indexed in: ERIH PLUS, Ebsco, SPORTDiscus, INDEX COPERNICUS JOURNAL MASTER LIST, DOAJ DIRECTORY OF OPEN ACCES JOURNALS, Caby, Gale Cengage Learning, Cabell's Directories

the training of military athletes in all naval pentathlon events. Vital capacity is the maximum volume of air that can be removed from the lungs after deep inspiration, immediately followed by forced expiration, and represents the oxygen supply level of the body. HR is measured with the help of a spirometer, "spirometry being the best method" (Dragnea & Bota 1999) for measuring aerobic exercise capacity. HR represents the number of beats per minute required by the heart to pump blood throughout the body.

Results

The respiratory frequency testing results are highlighted in table 1, both for the control and experimental groups, the asymmetry coefficients - β1 and β2 show values that highlight normal asymmetry. The distribution of the values-M1 ± DS1–for the experimental group and–M2 ± DS2–for the control group shows a normal distribution. The values of the coefficient of variability CV1 for the experimental group and CV2 - for the control group prove that there is a homogeneous population.

Table 1. Respiratory rate based on statistical indicators - initial test

Nr. crt	Experiment	Control	Respiratory frequency				
1	14.5	14.3	Number of subjects - N1 - Exp.	15			
2	14.2	14.8	Number of subjects- N2 - Ctrl.	15			
3	14.8	14.8	Median- M0 - Exp.	14.5			
4	14.9	14.1	Median- M0 - Ctrl.	14.3			
5	14.1	15	Asymmetry coefficient- β1 - Exp.	0	Normal asymmetry		
6	14.5	13.8	Asymmetry coefficient- β2 - Ctrl.	0	Normal asymmetry		
7	14.8	14.2	M1 ± DS1 - Exp.	14.5	±	0.321	
8	14.2	14.5	M2 ± DS2 - Ctrl.	14.3	±	0.382	
9	14	14	Distribution of values- M1 ± DS1 - Exp.	M1 ± 2DS1	Normal distribution of values		
10	15	13.8	Distribution of values- M2 ± DS2 - Ctrl.	M2 ± 2DS2	Normal distribution of values		
11	14.2	14.5	The coefficient of variability- CV1 - Exp.	2.214	%		Population homogeneity
12	14.3	14.3	The coefficient of variability- CV2 - Ctrl.	2.671	%		Normal distribution of values
13	14.8	14.5	df	28			
14	14.7	14.1	Independent "t" test	1.552			
15	14.5	13.8	Level of significance	p>0.05			

Table 2. Apnea time, statistical indicators, and initial testing

Nr.crt	Experiment	Control	Apnea time				
1	42	40.9	Number of subjects- N1 - Exp.	15			
2	41.3	40.5	Number of subjects- N2 - Ctrl.	15			
3	41.8	40.3	Median - M0 - Exp.	41.2			
4	40.9	38.9	Median - M0 - Ctrl.	40.9			
5	42.1	40.5	Asymmetry coefficient - β1 - Exp.	0.1	Normal asymmetry		
6	41.5	39.6	Asymmetry coefficient - β2 - Ctrl.	0	Normal asymmetry		
7	41.6	38.9	M1 ± DS1 - Exp.	41.253	±	0.53	
8	41.8	40.3	M2 ± DS2 - Ctrl.	40.9	±	1.184	
9	41	41.2	Distribution of values - M1 ± DS1 - Exp.	M1 ± 2DS1	Normal distribution of values		

10	40.5	41.6	Distribution of values - M2 ± DS2 - Ctrl.	M2 ± 2DS2	Normal distribution of values	
11	41	42.2	The coefficient of variability - CV1 - Exp.	1.285	%	Population of values homogeneity
12	40.5	41.9	The coefficient of variability - CV2 - Ctrl.	2.895	%	Population of values homogeneity
13	40.6	41.8	df	28		
14	41.2	42.4	Independent "t" test	1.054		
15	41	42.5	Level of significance	p>0.05		

In table 2, for both the control and experimental groups, the asymmetry coefficients - β1 and β2 reveal a normal asymmetry. The distribution of the values-M1 ± DS1–for the experimental group and M2SDSDS2 for the control group indicates a normal distribution of the values. The values of the coefficient of variability CV1 for the experiment group and CV2 - for the control group prove to us that there is a homogeneous population of values.

Table 3 Vital capacity-statistical indicators during the initial testing

Nr.crt	**Experiment**	**Control**	**Vital capacity**			
1	5010	5005	Number of subjects - N1 - Exp.	15		
2	5013	5010	Number of subjects - N2 - Ctrl.	15		
3	5007	5002	Median - M0 - Exp.	5010		
4	5010	5001	Median - M0 - Ctrl.	5005		
5	5010	5006	Asymmetry coefficient - β1 - Exp.	-0.235	Normal asymmetry	
6	5008	5010	Asymmetry coefficient - β2 - Ctrl.	0	Normal asymmetry	
7	5011	4998	M1 ± DS1 - Exp.	5009.5 ±	2.264	
8	5010	5011	M2 ± DS2 - Ctrl.	5005 ±	3.836	
9	5009	5005	Distribution of values - M1 ± DS1 - Exp.	M1 ± 3DS1	Large spread of values	
10	5014	5004	Distribution of values - M2 ± DS2 - Ctrl.	M2 ± 2DS2	Normal distribution of values	
11	5006	5004	The coefficient of variability - CV1 - Exp.	0.045	%	Population homogeneity
12	5010	5006	The coefficient of variability - CV2 - Ctrl.	0.077	%	Population homogeneity
13	5006	5009	df	28		
14	5008	5000	Independent "t" test	3.884		
15	5010	5004	Level of significance	p<0.0005		

As can be seen in table 3, for both the control and experimental groups, the asymmetry coefficients - β1 and β2 have values that specify a normal asymmetry. The spread of values-M1 ± DS1–for the experimental group showed a large spread of values, whereas–M2 ± DS2–for the control group showed a normal spread of values. The values of the coefficient of variability CV1 for the experimental group and CV2 - for the control group prove that there is a homogeneous population.

Table 4. Heart rate (HR) - statistical indicators - initial testing

Nr.crt	**Experiment**	**Control**	**Heart rate**		
1	67.3	68.3	Number of subjects - N1 - Exp.	15	
2	68.5	69	Number of subjects - N2 - Ctrl.	15	
3	67.7	68.3	Median - M0 - Exp.	67.8	
4	67.8	68	Median - M0 - Ctrl.	68.3	

5	68.4	68.4	Asymmetry coefficient - β1 - Exp.	0.127		Normal asymmetry
6	67.8	67.8	Asymmetry coefficient - β2 - Ctrl.	0.103		Normal asymmetry
7	68.5	69.2	M1 ± DS1 - Exp.	67.9	±	0.786
8	68.7	69.2	M2 ± DS2 - Ctrl.	68.38	±	0.778
9	67.2	68.2	Distribution of values - M1 ± DS1 - Exp.	M1 ± 2DS1		Normal distribution of values
10	66.4	67	Distribution of values - M2 ± DS2 - Ctrl.	M2 ± 2DS2		Normal distribution of values
11	67.1	67.3	The coefficient of variability - CV1 - Exp.	1.158	%	Population of values homogeneity
12	67.1	67.4	The coefficient of variability - CV2 - Ctrl.	1.138	%	Population of values homogeneity
13	68.2	68.9	df	28		
14	68.4	69.2	Independent "t" test	1.681		
15	69.4	69.5	Level of significance	p>0.05		

In table 4, the asymmetry coefficients - β1 and β2, both for the control and experimental groups indicate the existence of normal asymmetry. The distribution of values-M1 ± DS1–for the experimental group and–M2 ± DS2–for the control group shows a normal distribution of values. The values of the coefficient of variability CV1 for the experiment group and CV2 - for the control group prove to us that there is a homogeneous population of values.

The functional capacity parameters were highlighted through the scientific management of training and the knowledge of the functional state of athletes' bodies. At the intermediate testing, the calculation of the difference between the means showed significant values in favor of the experimental group at n 1 (p = 0.05, only for the vital capacity, at the final testing (table 5), the mean values showed changes in all the functional parameters studied . Thus, the average respiratory frequency at the final test was 12.00 resp/minute for the subjects of the experimental group and 13.00 resp/minute for the control group.

Table 5. Respiratory frequency, statistical indicators - final test

Nr.crt	Experiment	Control	Respiratory rate			
1	12	13	Number of subjects - N1 - Exp.	15		
2	11	13	Number of subjects - N2 - Ctrl.	15		
3	11.5	13.2	Median - M0 - Exp.	12.1		
4	11	13	Median - M0 - Ctrl.	13		
5	12.1	13	Asymmetry coefficient - β1 - Exp.	-0.166		Normal asymmetry
6	13.2	13	- Asymmetry coefficient β2 - Ctrl.	0		Normal asymmetry
7	12.2	13.1	M1 ± DS1 - Exp.	12	±	0.601
8	12.1	13.1	M2 ± DS2 - Ctrl.	13	±	0.288
9	11.3	13	Distribution of values - M1 ± DS1 - Exp.	M1 ± 2DS1		Normal distribution of values
10	12.8	12	Distribution of values - M2 ± DS2 - Ctrl.	M2 ± 4DS2		Large distribution of values
11	12.3	13.2	The coefficient of variability - CV1 - Exp.	5.008	%	Population homogeneity
12	12.2	13.1	The coefficient of variability - CV2 - Ctrl.	2.215	%	Population homogeneity
13	12	13.2	df	28		
14	12.1	13.1	Independent "t" test	5.811		
15	12.2	13	Level of significance	p<0.0005		

As can be seen in table 5, for both the control group and for the experimental group, the asymmetry coefficient - β1 and β2 show values that highlight a normal asymmetry. The spread of values-M1 ± DS1 – for the experimental group shows a normal spread of values and – M2 ± DS2 – for the control group, shows a large spread of values. The values of the coefficient of variability CV1 for the experimental group and CV2 - for the control group prove that there is a homogeneous population.

Table 6. Apnea time, statistical indicators – final test

Nr.crt	Experiment	Control	Apnea time				
1	55	50.9	Number of subjects - N1 - Exp.	15			
2	55.3	51.8	Number of subjects	15			
3	54.8	51.3	Median - M0 - Exp.	55			
4	57.7	50.9	Median - M0 - Ctrl.	51.8			
5	55.5	50.5	Asymmetry coefficient - β1 - Exp.	0			Normal asymmetry
6	54.5	50.8	Asymmetry coefficient - β2 - Ctrl.	-0.356			Normal asymmetry
7	54.6	51.9	M1 ± DS1 - Exp.	55	±	1.415	
8	53.8	52.3	M2 ± DS2 - Ctrl.	51.5	±	0.842	
9	55.4	52.2	Distribution of values - M1 ± DS1 - Exp.	M1 ± 3DS1			Large distribution of values
10	56.8	52.5	Distribution of values - M2 ± DS2 - Ctrl.	M2 ± 2DS2			Normal distribution of values
11	56.6	50.2	The coefficient of variability - CV1 - Exp.	2.573		%	Population homogeneity
12	55.4	51.9	The coefficient of variability - CV2 - Ctrl.	1.635		%	Population homogeneity
13	53.1	52.5	df	28			
14	52.1	50.3	Independent "t" test	8.233			
15	54.4	52.5	Level of significance	p<0.0005			

As can be seen in table 6, the coefficient of asymmetry - β1, for the experimental group, shows normal asymmetry, and for the control group the coefficient of asymmetry - β2, has a notable asymmetry. The spread of values-M1 ± DS1 – for the experimental group, shows a large spread of values and – M2 ± DS2 – for the control group, shows a normal spread of values. The values of 2,573 and 1,635 of the coefficient of variability CV1 for the experimental group and CV2 - for the control group, demonstrate that there is a homogeneous population.

Table 7. Vital capacity, statistical indicators – final test

Nr.crt	Experiment	Control	Vital capacity				
1	5525	5350	Number of subjects - N1 - Exp.	15			
2	5510	5410	Number of subjects - N2 - Ctrl.	15			
3	5410	5295	Median - M0 - Exp.	5525			
4	5620	5410	Median - M0 - Ctrl.	5350			
5	5600	5410	Asymmetry coefficient - β1 - Exp.	0.516			Normal asymmetry
6	5510	5300	Asymmetry coefficient - β2 - Ctrl.	0.005			Normal asymmetry
7	5515	5310	M1 ± DS1 - Exp.	5586	±	118.158	
8	5610	5410	M2 ± DS2 - Ctrl.	5350.333	±	65.173	
9	5505	5309	Distribution of values - M1 ± DS1 - Exp.	M1 ± 2DS1			Normal distribution of values
10	5500	5415	Distribution of values - M2 ± DS2 - Ctrl.	M2 ± 3DS2			Large distribution of values

11	5480	5206	The coefficient of variability - CV1 - Exp.	2.115	%	Population homogeneity
12	5680	5310	The coefficient of variability - CV2 - Ctrl.	1.218	%	Population homogeneity
13	5780	5300	df	28		
14	5750	5410	Independent "t" test	6.764		
15	5795	5410	Level of significance	p<0.0005		

As can be seen in table 7, for both the control and experimental groups, the asymmetry coefficients - β1 and β2 have values that highlight a normal asymmetry. The scatter of the values - M1 ± DS1 – for the experimental group shows a normal scatter of the values and – M2 ± DS2 – for the control group, shows a large scatter of the values. The values of the coefficient of variability CV1 for the experiment group and CV2 - for the control group, prove to us that there is a homogeneous population.

Table 8. Heart rate – statistical indicators – final test

Nr.crt	Experiment	Control	Heart rate				
1	62	64.3	- Number of subjects N1 - Exp.	15			
2	63.5	64.2	Number of subjects - N2 - Ctrl.	15			
3	62.7	63.3	Median - M0 - Exp.	62.2			
4	62.8	64.1	Median - M0 - Ctrl.	64			
5	63	62.7	Asymmetry coefficient - β1 - Exp.	-0.192		Normal asymmetry	
6	62.8	64	Asymmetry coefficient - β2 - Ctrl.	0		Normal asymmetry	
7	60.6	64.2	M1 ± DS1 - Exp.	62	±	1.043	
8	61.7	64	M2 ± DS2 - Ctrl.	64	±	0.553	
9	61.2	64	Distribution of values - M1 ± DS1 - Exp.	M1 ± 3DS1		Large distribution of values	
10	59.4	63.4	Distribution of values - M2 ± DS2 - Ctrl.	M2 ± 3DS2		Large distribution of values	
11	61.9	63.8	The coefficient of variability - CV1 - Exp.	1.682		%	Population homogeneity
12	62.3	64.4	The coefficient of variability - CV2 - Ctrl.	0.864		%	Population homogeneity
13	62.2	64.6	df	28			
14	62.5	65	Independent "t" test	6.561			
15	61.4	64	Level of significance	p<0.0005			

In table 8, for both the control group and for the experimental group, the asymmetry coefficients - β1 and β2 show values that highlight a normal asymmetry. The spread of values was large for both the experimental group - M1 ± DS1 - and for the control group - M2 ± DS2. The values of the coefficient of variability CV1 for the experimental group and CV2 - for the control group, demonstrate that there is a homogeneous population. In this test, the calculation of the difference between the average results of the two groups revealed a $t= 6.76>4.073$, at $p=0.0005$, n-1, the difference being statistically significant. From the analysis of the group averages that characterize the functional capacity of military athletes, we noticed that the averages of the results of the functional capacity tests, which were applied at different times of our research, register progress from one stage to another at n-1, $p=0.0005$. The increase in the means of the functional parameters subjected to the research confirms the good state of training, respectively the viability of the experiment from a functional point of view. At the same time, the veracity of the results is a consequence of the implementation in the training model of the structures of means specific to the seafaring skills test.

Conclusions

In the study conducted, the application of the tests, which investigates the functional capacity, demonstrated that from a statistical point of view, for the experimental group, the mean values became significant at the final test for vital capacity (at n-1; $p=0.05$) and respiratory frequency. This significant difference for the experimental group was the result of implementing the content of the training program of the structures of specific means, optimally dosed, specific to the seafaring skills test.

References

Bota, C. (2000). *Ergofiziologie*. București: Editura Globus.
Dragnea, A., Bota, A. (1999). *Teoria activităţilor motrice*. Bucureşti: Editura Didactică şi Pedagogică R.A.
Dragnea, A., Mate -Teodorescu, S. (2002). *Teoria Sportului*, Editura FEST, București.
Drăgan, I. (2002) - citat de Bădescu, V., *Monitorizarea antrenamentului înotătorilor prin repere biologice semnificative*, Edit. Universitaria, Craiova, 2006.
Olbrecht, J. (2000). *The science of winning, planning, periodizing and optimizing swim training*. Editura Luton.
Teodorescu, S. (2009). *Antrenament și competiție*, Buzău: Editura ALPHA MDN, p.178.
http://medical-dictionary.thefreedictionary.com/apneea.