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Body adaptation peculiarities in 15–17-year-old juniors training for cycling and rowing sports

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The aim of our work was to examine junior cyclists and rowers from the Lithuanian Olympic reserve, to define the specific features of their bodily adaptation, to look for relations between these features and special performance.

Materials and methods. We examined 39 sportsmen (age, 15–17 years) from the Lithuanian Olympic reserve, of them 19 were rowers and 20 cyclists.

The indices of their physical development, single muscular contraction power and anaerobic alactic muscular power were established. Special performance was evaluated by 10-s and 30-s test loads on special ergometers.

To assess the functional capacity of the circulatory system, we measured the pulse rate at rest, in orthostasis, in response to a standard physical load and after 60 s of recovery. The Roufier index was also calculated. Aerobic capacity was determined at the critical intensity limit (CIL) and at the anaerobic threshold limit (ATL).

We determined the rate of psychomotoric response and central nervous system liability by applying a 10-s tapping test.

Results. Junior sportsmen training aerobic endurance differ in their physical development indices depending on the peculiarities of a sports branch. The rowers showed higher body size indices. Despite differences in physical development indices and the means and methods of training applied, the indices of velocity, SMCP and AAMP showed no essential differences in sportsmen of different sports branches. These indices are not related to special performance indices. In junior rowers, whose body mass was higher, the functional capacity of the circulatory system was lower than in the cyclists whose body mass was lower. Therefore attention should be given to physical load individualization in order not to overburden the circulatory system as long as it lags behind physical development indices. The absolute values of VO_2 max were higher in the cyclists. Correlative investigations showed that in junior sportsmen the height, body mass and muscular mass are interrelated with the special performance indices in 10-s and 30-s tests.

Key words: cyclists, rowers, aerobic endurance, physical development, functional capacity, special fitness, correlative ties

INTRODUCTION

In cycling and rowing sports, in the contest period aerobic reactions prevail in energy production. In rowing sports, while covering a distance of 2 km, more than 80% of energy is produced by using oxygen (1, 2). Also, the anaerobic alactic and glycolytic reactions under such load attain the maximum (3). While rowing for this distance the contribution of aerobic reactions increases, however, the role of anaerobic alactic and glycolytic energy production reactions is preserved, as at starting, accelerating and finishing these reactions become strongly intensified (4, 5). The same scheme of energy production holds true also for cycling sports. Therefore studies of adaptation to physical loads in junior cyclists and rowers should involve not only investigations of the dynamics of their aerobic power, but also the monitoring of the activity of their anaerobic alactic and glycolytic reactions.

Aerobic capacity in sportsmen first of all depends on the ability of their muscles to uptake oxygen while performing a mechanical load, on the ability of their respiratory and circulatory systems to deliver oxygen into the functioning muscles, to eliminate metabolic waste (6, 7).

While examining sportsmen, most of their aerobic capacity indices are measured at the critical intensity limit and at the anaerobic metabolism threshold limit (8, 9). In Lithuania, adaptation to physical loads in adult sportsmen training their aerobic reactions is given extensive studies (10–13), whereas studies of these aspects in junior sportsmen are rather sparce. Of interest is the interrelation between the aerobic and anaerobic capacity indices and special performance in junior sportsmen. A scientific problem arose to highlight the peculiarities of bodily adaptation in junior sportsmen training in cycling and rowing sports in which during contests, while performing very powerful work, the leading role belongs to the aerobic power, although the specific features of physical development in representatives of these sports branches differ rather significantly and depend on the genetically predetermined parameters.

The aim of our work was to examine junior cyclists and rowers (age, 15–17 years) from the Lithuanian Olympic reserve, to evaluate the specific features of their bodily adaptation, to look for relations between these features and the indices of special physical performance.

METHODS

Over the 2002–2003 training period, we examined 39 sportsmen (age, 15–17 years) from the Lithuanian Olympic reserve, of them 19 rowers and 20 cyclists. Their training experience was 3 to 5 years.

The following indices of physical development were determined: height, body mass, left and right hand force, lung volume (LV), fat and muscle mass; the fat muscle mass index (FMMI) was calculated (14). To assess single muscle contraction power (SMCP) we applied the high jump test with measuring the pushoff time (15). The staircase running test was used to measure anaerobic alactic muscular power (AAMP) (16). Special ergometers were employed to determine special performance under 10-s and 30-s work (17).

The functional capacity of the circulatory system was assessed by measuring the pulse rate at rest, in orthostasis, in response to a standard physical load (30 squattings per 45 s) and after a 60-s rest. Also, the Roufier index (RI) was calculated (18). Physical loads with special ergometers and gas analyzers were used to assess the aerobic capacity indices at the critical intensity limit (CIL) (19) and at the anaerobic threshold limit (ATL) (20, 21).

The psychomotoric response rate (PRR) and CNS liability were assessed with the aid of a 10-s tapping test.

Mathematical statistics methods were employed to analyse the obtained data by calculating the arithmetical mean (X–), error (Sx–), standard deviation (S), the variation coefficient (V). To assess the difference reliability between the groups, Student's t criterion for independent samples was applied. Relations among the indices were defined by the direct intercorrelation method.

RESULTS

Analysis of the physical development of the study subjects (Table 1) showed that the mean values of many of the indices were significantly higher in rowers than in cyclists. Of interest is the fact that hand force in rowers was not higher than in cyclists, though while performing sports activities the rowers' hands perform much work; the scattering of their force indices was very high and reached 19.08 and 22.06 per cent.

The largest scattering was found in the rowers' fat mass index. The total scattering area was 5.5 to 13.8 kg. In some of the study subjects (young athletes) the fat mass was low, implying possible deviations in their development.

The indices of velocity, SMCP an AAMP (Table 2) show that there were no essential differences in vertical high jump, pushoff rate, psychomotric response time, motion frequency between the groups. The scattering of these indices was not large. Thus in sportsmen with rather different levels of physical

Table 1. **Data on physical development of junior cyclists and rowers**

	Indices	Height, cm	Body mass, kg	Hand force, kg		Lung volume, l	Fat mass, kg	Muscle mass, kg	FMMI
				Right	Left				
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
	$\bar{X}$	182.65	70.22	45.50	42.15	4.84	6.65	37.38	5.84
Group 1	$S\bar{x}$	1.58	1.72	2.25	2.11	0.11	0.39	0.95	0.26
Cyclists	*S*	7.07	7.70	10.05	9.42	0.50	1.73	4.23	1.18
n = 20	*V*	3.87	10.97	22.09	22.34	10.33	26.02	11.32	20.21
	Min	167.50	58.50	28.00	26.00	4.00	4.00	31.90	3.84
	Max	201.00	96.50	65.00	64.00	5.60	11.80	51.40	8.76

Table 1 continued

1	2	3	4	5	6	7	8	9	10
	$\bar{X}$	188.50	82.86	45.21	43.42	5.56	8.46	45.31	5.60
Group 2	$S\bar{x}$	1.29	2.41	1.98	2.20	0.15	0.54	1.38	0.24
Rowers	S	5.63	10.51	8.63	9.58	0.64	2.37	6.00	1.05
n = 19	V	2.98	12.68	19.08	22.06	11.51	28.01	13.24	18.75
	Min	176.50	61.00	25.00	20.00	4.50	5.50	31.50	3.89
	Max	200.00	108.50	64.00	62.00	6.60	13.80	57.90	7.34
Mean value difference	t	2.85	4.30	0.10	0.42	3.94	2.73	4.79	0.86
reliability between the groups	p	0.01	0.001			0.001	0.01	0.001	0.4

Table 2. **Data on muscular power and psychomotor functions of junior cyclists and rowers**

	Indices	High jump, cm	Pushoff time, ms	SMCP, kgm/s/ kg	AAMP, kgm/s/ kg	PRR, ms	Motion frequency, 10 s
	$\bar{X}$	43.55	207.27	2.15	1.62	186.70	76.95
Group 1	$S\bar{x}$	1.28	7.14	0.09	0.03	3.58	1.41
Cyclists	S	5.73	31.95	0.40	0.13	16.02	6.31
n = 20	V	13.16	15.41	18.60	8.02	8.58	8.20
	Min	33.00	169.00	1.27	1.36	145.00	63.00
	Max	54.00	276.00	2.76	1.87	222.00	89.00
	$\bar{X}$	44.14	198.55	2.26	1.58	192.62	76.33
Group 2	$S\bar{x}$	1.45	5.56	0.09	0.02	3.51	1.61
Rowers	S	6.67	25.50	0.43	0.11	16.09	7.38
n = 19	V	15.11	12.84	19.02	6.96	8.38	9.67
	Min	34.00	153.00	1.54	1.42	162.00	62.00
	Max	61.00	235.00	3.07	1.79	226.00	88.00
Mean value difference	t	0.30	0.97	0.89	0.87	1.18	0.29
reliability between the groups	p		0.85	0.4	0.4	0.4	

development and exposed to different loads the velocity and muscular power under short-lasting load differed only insignificantly.

Under a 10-s maximum strain on special ergometers, its mean power values between the groups showed a more significant difference, however, the wide scattering made the differences statistically not significant (Table 3). The differences were more pronounced when the indices of the 30-s performance were compared. In rowers they were statistically re-

Table 3. **Data on special performance of junior cyclists and rowers**

	Indices	Power W		Pulse rate, b/min				Blood pressure			
		10s	30s	After load	After 1 min	After 2 min	After 3 min	After load		After 3 min	
								Systol.	Diastol.	Systol.	Diastol.
1	2	3	4	5	6	7	8	9	10	11	12
	$\bar{X}$	839.15	578.40	182.85	151.70	128.85	117.05	171.50	28.75	151.50	46.75
Group 1	$S\bar{x}$	21.56	12.70	1.70	2.31	2.45	2.42	3.29	2.35	3.31	2.15
Cyclists	S	96.43	56.80	7.60	10.35	10.96	10.84	14.70	10.50	14.79	9.63
n = 20	V	11.49	9.82	4.18	6.82	8.56	9.26	8.60	36.52	9.79	20.60
	Min	580.00	473.00	171.00	133.00	113.00	96.00	130.00	10.00	120.00	30.00
	Max	999.00	741.00	199.00	169.00	152.00	138.00	190.00	45.00	175.00	65.00

Table 3 continued

1	2	3	4	5	6	7	8	9	10	11	12
	$\bar{X}$	687.81	483.94	174.38	140.94	117.00	108.81	160.63	35.94	146.88	47.81
Group 2	$S\bar{x}$	47.08	29.71	1.87	2.58	3.42	2.97	3.09	1.39	4.76	1.99
Rowers	S	188.32	118.84	7.47	10.34	13.68	11.87	12.37	5.54	19.05	7.95
n = 19	V	27.38	24.60	4.29	7.39	11.69	10.99	7.73	15.41	13.05	16.63
	Min	374.00	273.00	160.00	123.00	93.00	90.00	140.00	30.00	130.00	35.00
	Max	999.00	659.00	186.00	164.00	140.00	132.00	180.00	45.00	210.00	60.00
Mean value difference	t	0.89	–1.77	–0.22	2.38	1.42	0.74	–0.13	–2.06	0.12	–0.60
reliability between the groups	p	0.4	0.1		0.02				0.05		

liably lower than in cyclists, though the scattering of these indices was large (V = 24.60%). The scattering area reached 273.00 to 659W. It could have been influenced by the specific character of mastering the skills of rowing an ergometer.

Analysis of data on the functional capacity of the circulatory system (Fig. 1) showed that the RI was higher in rowers than in cyclists. Also the pulse rate, in all three measurements, was higher in rowers (Fig. 2). It could be explained by a higher total and muscular mass of the rowers, and the heart has to make more contractions to serve it. Its development often lags behind body mass increase.

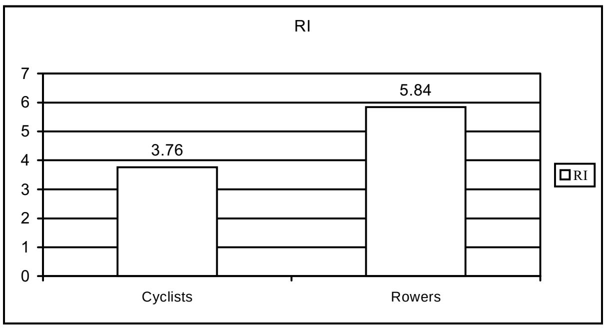

Fig. 1. Roufier index of junior cyclists and rowers

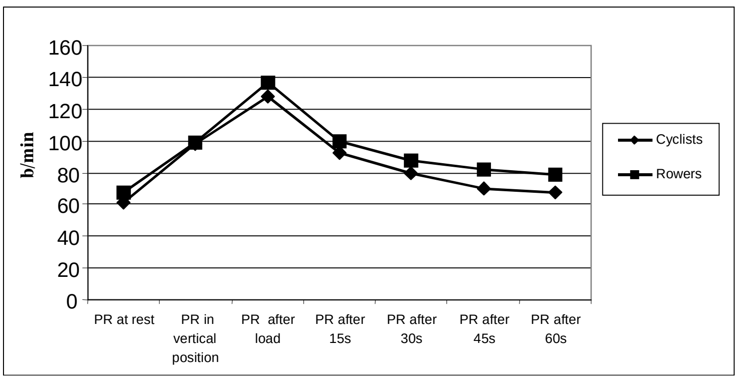

Fig. 2. Pulse rate dynamics in junior cyclists and rowers

Both the diastolic and systolic blood pressure at rest showed no essential differences between the groups.

When the physical load reached the critical intensity, when O_2 uptake reached its maximum (VO_2 max), a pronounced superiority of cyclists over the rowers was revealed (Table 4). However, in rowers the indices of lung ventilation, pulse rate and performance were higher. Rowers showed also a higher working efficiency and the difference was statistically reliable. At the anaerobic threshold limit the pulse rate was almost the same in both groups. Absolute oxygen uptake was nearly the same, however, relative oxygen uptake for a kilogram of body weight was higher in cyclists, and this difference was evident ($p < 0.001$). The largest scattering was shown by rowers in performance power at critical intensity limit (V = 21.84%), the lowest index being more than half as high as the highest one.

Correlative studies showed the height to be essentially related to total body mass, muscular mass, lung volume, 10-s and 30-s working power (Table 5). Body mass showed nearly the same correlative ties. However, these ties between hand force and muscular mass, as well as 10-s and 30-s performance power were weak. Lung volume was essentially related with muscular mass and weakly related to 10-s and 30-s performance power. The result of high jump correlates only with SMCP, the latter index showing no relation to any other index of those studied. Their interrelation is essential (r = 0.63). The RI and pulse rate at rest and after a standard load are strongly interrelated and are equivalent, able to substitute or complement each other. Lung ventilation at CIL is strongly related to abs. VO_2 max (Fig. 3), oxygen pulse rate, performance power. VO_2 max is very strongly related to oxygen pulse index

Table 4. **Data on aerobic capacity of junior cyclists and rowers**

	Indices	Critical intensity limit							Anaerobic threshold limit							
		LV l/min	PR b/min	VO_2 l/min	VO_2 ml/min/kg	OP ml/b	W	O_2 ml/W	LV l/min	PR b/min	VO_2 l/min	VO_2 ml/min/kg	OP ml/b	O_2 % VO_2 max	W	O_2 ml/W
	X–	142.92	185.67	4.73	69.66	25.46	372.08	12.78	90.05	165.83	3.75	55.24	22.40	78.55	298.33	14.38
Group 1	*Sx–*	6.19	2.89	0.15	1.86	0.61	10.93	0.41	2.39	1.80	0.12	1.96	0.56	1.74	8.15	1.91
Cyclists	*S*	21.43	9.99	0.52	6.43	2.12	37.87	1.43	8.30	6.22	0.43	6.79	1.95	5.76	28.23	6.61
n = 20	*V*	14.99	5.38	5.38	9.23	8.33	10.18	11.19	9.22	3.77	11.47	12.29	8.70	7.33	9.47	45.97
	Min	124.50	167.00	3.82	59.70	22.80	300.00	11.42	75.60	154.00	3.17	44.00	19.50	69.36	240.00	10.18
	Max	198.40	198.00	5.73	77.70	29.40	410.00	15.53	102.10	174.00	4.39	64.60	25.00	85.85	350.00	34.70
	X–	157.57	188.93	5.05	58.19	26.40	415.00	11.39	89.43	165.50	3.81	43.83	23.04	75.61	257.50	15.06
Group 2	*Sx–*	4.04	2.10	0.19	1.63	1.01	24.22	0.40	3.38	1.48	0.16	1.31	1.06	1.84	14.57	0.60
Rowers	*S*	14.01	7.86	0.67	5.66	3.51	90.62	1.40	11.71	5.13	0.57	4.54	3.67	6.36	50.48	2.07
n = 19	*V*	8.89	4.18	13.27	9.73	13.30	21.84	12.29	13.09	3.09	14.96	10.36	15.93	8.41	19.60	13.71
	Min	120.00	172.00	3.42	43.42	18.00	250.00	8.76	71.48	154.00	2.76	34.92	16.52	65.66	150.00	12.90
	Max	172.10	198.00	5.95	64.56	31.09	510.00	13.83	113.40	172.00	4.82	49.10	30.07	83.50	340.00	19.28
Mean value difference	*t*	–1.98	–0.93	–1.28	4.64	–0.79	–1.53	2.41	0.15	0.14	–0.28	4.84	–0.54	1.16	2.45	–0.34
reliability between the groups	*p*	0.05	0.4	0.2	0.001	0.5	0.2	0.025				0.001		0.1		

Table 5. **Intercorrelative scale of the indices studied**

No.	Height, cm	Body mass, kg	Right hand force, kg	LV, l	Muscle mass, kg	Jump height, cm	SMCP, kgm/s/kg	AAMP, kgm/s/kg	RI	PR at rest, b/min	PR after physical load, b/min	Power, W		Critical intensity limit					Anaerobic threshold limit			
												10s	30s	LV l/min	VO_2 l/min	VO_2 ml/min/kg	OP ml/b	W	LV l/min	VO_2 l/min	VO_2 ml/min/kg	W
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
1	1																					
2	0.78	1																				
3	0.33	0.42	1																			
4	0.51	0.58	0.27	1																		
5	0.73	0.98	0.43	0.60	1																	
6	–0.08	0.00	0.24	0.02	0.06	1																
7	–0.17	–0.02	0.17	0.22	0.07	0.63	1															
8	–0.13	–0.10	0.07	0.02	–0.08	0.45	0.44	1														
9	0.17	0.18	0.13	0.16	0.20	0.35	0.08	0.08	1													
10	–0.02	0.07	0.16	0.19	0.11	0.37	0.26	0.16	0.85	1												
11	0.29	0.21	0.01	0.07	0.22	0.15	–0.07	–0.05	0.76	0.47	1											
12	0.48	0.69	0.75	0.41	0.71	0.22	0.12	0.06	0.15	0.15	0.10	1										
13	0.59	0.79	0.65	0.36	0.77	0.16	–0.10	0.13	0.10	0.07	0.02	0.76	1									
14	–0.19	–0.17	–0.03	0.05	–0.17	0.01	0.09	0.53	0.17	0.26	–0.01	–0.23	0.10	1								
15	0.05	–0.16	–0.04	–0.24	–0.20	–0.11	–0.01	0.34	0.10	0.03	0.06	–0.02	–0.04	0.59	1							
16	–0.11	–0.16	0.21	–0.41	–0.21	–0.18	–0.09	0.25	–0.22	–0.18	–0.13	0.49	0.38	0.05	0.30	1						
17	0.13	–0.05	0.00	–0.27	–0.10	–0.17	–0.08	0.21	0.01	–0.06	–0.08	0.04	–0.01	0.44	0.92	0.34	1					
18	0.08	–0.21	0.02	0.08	–0.24	–0.10	–0.21	0.13	–0.06	–0.09	0.01	–0.22	–0.08	0.58	0.60	–0.14	0.47	1				
19	–0.37	–0.13	–0.21	–0.32	–0.12	–0.01	–0.19	0.22	–0.34	–0.31	–0.51	–0.37	–0.11	0.26	0.17	0.03	0.25	0.18	1			
20	–0.14	–0.20	–0.09	–0.38	–0.25	–0.05	–0.22	0.38	–0.08	–0.19	–0.22	0.00	0.07	0.41	0.78	0.36	0.77	0.40	0.58	1		
21	–0.24	–0.17	0.11	–0.43	–0.21	–0.12	–0.25	0.24	–0.33	–0.32	–0.33	0.44	0.44	–0.07	0.11	0.86	0.19	–0.24	0.36	0.50	1	
22	–0.18	–0.21	–0.04	–0.29	–0.23	–0.18	–0.24	0.25	–0.38	–0.32	–0.51	0.13	0.20	0.17	0.26	0.46	0.32	0.26	0.57	0.48	0.55	1

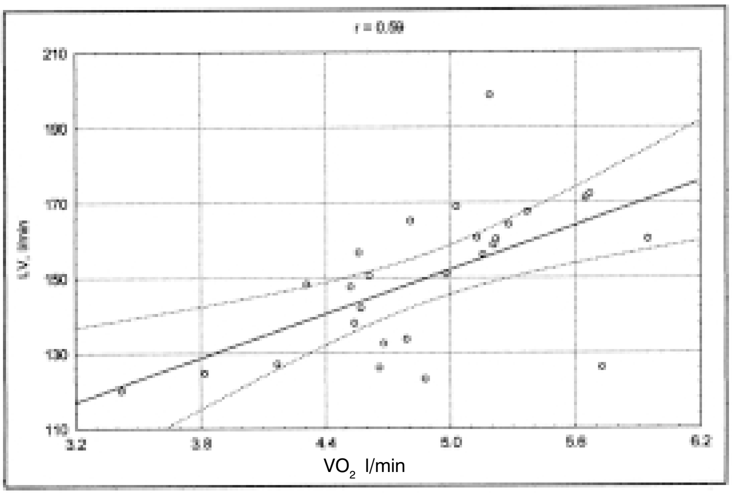

Fig. 3. Correlation between lung ventilation CIL and absolute VO_2 max indices

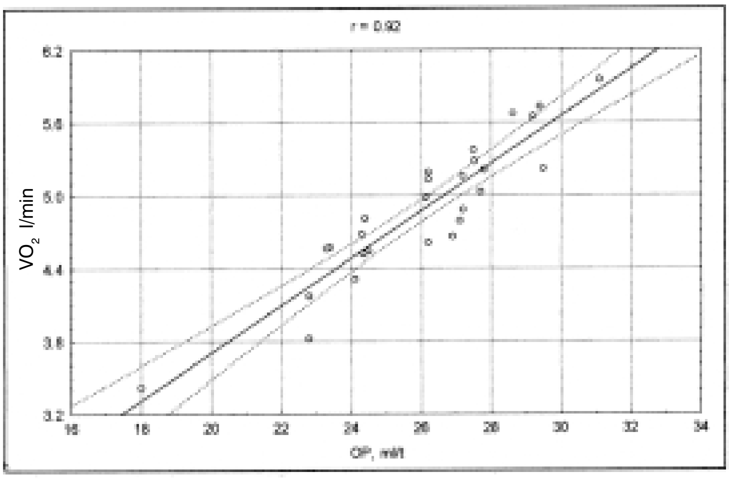

Fig. 4. Correlation between VO_2 max and oxygen pulse rate indices

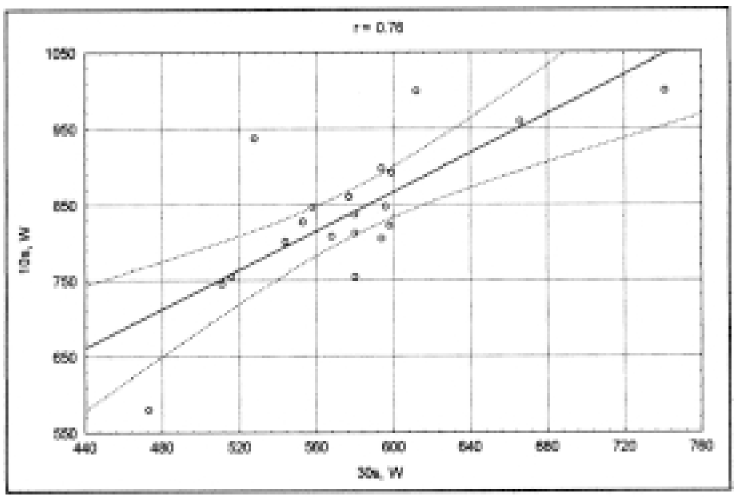

Fig. 5. Correlation between 10-s and 30-s special performance indices

(Fig. 4) and to VO_2 at the anaerobic metabolism threshold limit and essentially related to the working power. The relative VO_2 max showed no strong relation with the other indices studied, but it had a strong relation to the relative VO_2 value at the anaerobic threshold limit. Special 10-s and 30-s performance is weakly dependent on aerobic capacity indices; only the relative VO_2 max index shows a slight influence on working power in these zones of work duration. At the anaerobic threshold limit lung ventilation is related with VO_2 and performance indices. Oxygen uptake at CIL and ATL are essentially correlated and the indices of these tests are essentially related with hand force and muscular mass indices. The interrelation between the 10-s and 30-s test indices is high (r = 0.76) (Fig. 5). They are dependent on both the common and the different factors and cannot fully substitute each other.

DISCUSSION

In general, the indices of physical development were found to be higher in rowers. Despite the differences in training means and methods, the junior sportsmen showed similar indices of velocity, SMCP, AAMP and 10-s special performance. This fact may imply that their special training needs more attention and time.

Worth attention is the high number of young men with a very low fat mass, as it may be an obstacle in their development and sports career (23).

The functional backwardness of the circulatory system in the junior rowers can be explained by the fact that in the presence of a higher total and muscular mass the circulatory system is lagging behind and needs more effort in order to serve body with the necessary quantities of oxygen, energetic and other substances. Therefore physical load should be distributed particularly carefully in their coaching and individualized according to the functional capacity of the circulatory system of a sportsmen (10). The scientists who studied the preparation process of juvenile sportsmen noticed it (24).

The height, body mass, muscular mass, hand force, LV indices showed an essential relation to special performance under

10-s and 30-s loads. The indices of velocity, SMCP and AAMP were not related to special performance indices, therefore these indices should be compared to the corresponding optimum values.

The strongly interrelated 10-s and 30-s special performance test indices are also strongly related to aerobic capacity, VO_2 max relative value per 1 kg of body mass registered at CIL and to relative oxygen uptake at ATL.

CONCLUSIONS

1. Junior sportsmen training in rowing and cycling differ in their physical development data depending on the peculiarities of a sports branch. The body measurement indices were higher in rowers.

2. Despite the differences in physical development indices and in the means and methods of training applied, the agility, SMCP and AAMP indices in the two groups of sportsmen showed no essential differences. These indices showed no relation to the special performance indices.

3. The functional capacity of the circulatory system of the young rowers whose body mass indices were higher lagged behind this index of the young cyclists whose mass was lower. Therefore, attention should be given to the individual dosage of physical load so as not to overburden the circulatory system, which is yet lagging behind the physical development indices.

4. The absolute values of VO_2 max at CIL and ATL showed no reliable difference between the groups, and the relative VO_2 max index per 1 kg of body mass was higher in cyclists.

5. Correlative studies showed that the height, body mass and muscular mass, hand force of the young sportsmen were closely related with the 10-s and 30-s special performance test indices. Among Only the relative VO_2 max values per 1 kg of body mass (ml/min/kg) registered at the CIL and ATL were influenced by the aerobic capacity indices.

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15–17 METŲ JAUNUOLIŲ ORGANIZMO ADAPTACIJOS YPATUMAI TRENIRUOJANTIS DVIRAČIŲ IR IRKLAVIMO SPORTE

S a n t r a u k a

Darbo tikslas buvo ištirti 15–17 metų Lietuvos olimpinio rezervo jaunuosius dviratininkus ir irkluotojus, nustatyti jų organizmo adaptacijos specifinius požymius, ieškoti ryšių tarp šių požymių ir specialaus fizinio darbingumo.

Darbo metodika. Ištyrėme 39 15–17 metų Lietuvos olimpinio rezervo sportininkus, iš jų – 19 irkluotojų ir 20 dviratininkų.

Nustatėme fizinį išsivystymą, vienkartinį raumenų susitraukimo galingumą, anaerobinį alaktatinį raumenų galingumą. Specialų darbingumą įvertinome atitinkamais ergometrais.

Kraujotakos sistemos funkcinį pajėgumą įvertinome užfiksuodami pulso dažnį ramybės metu, ortostazėje, reaguojant į standartinį fizinį krūvį ir atsigaunant 60 s; taip pat apskaičiavome Rufje indeksą. Aerobinį pajėgumą nustatėme ties kritine intensyvumo riba (KIR) ir anaerobinės apykaitos slenksčio riba (ASR).

Psichomotorinės reakcijos greitį ir centrinės nervų sistemos paslankumą parodė 10 s „tempingo“ testas.

Rezultatai. Aerobinę ištvermę lavinantys jaunieji sportininkai pagal sporto šakos specifiką skiriasi fizinio išsivystymo duomenimis, didesniais kūno išmatavimo rodikliais pasižymėjo irkluotojai. Esant skirtingiems fizinio išsivystymo rodikliams, nevienodoms treniruočių priemonėms ir metodams, atskirų sporto šakų sportininkų greitumo, VRSG ir AARG rodikliai iš esmės nesiskyrė. Šie rodikliai neturi ryšio su specialaus darbingumo rodikliais. Jaunųjų irkluotojų, turinčių didesnę kūno masę, kraujotakos sistemos funkcinis pajėgumas atsilieka nuo dviratininkų, kurių kūno masė mažesnė. Atkreiptinas dėmesys į irkluotojų fizinio krūvio individualizavimą neperkraunant kraujotakos sistemos, kol ji dar atsilieka nuo fizinio išsivystymo rodiklių. VO_2 max absoliutūs dydžiai KIR ir ASR tarp tirtų grupių sportininkų patikimai nesiskyrė, tuo tarpu dviratininkų santykiniai 1 kg kūno masės VO_2 max rodikliai buvo didesni. Pagal tyrimo duomenų koreliacinių ryšių analizę, jaunųjų sportininkų ūgis, kūno masė ir raumenų masė turi ryšius su 10 s ir 30 s trukmės specialaus darbingumo testo rodikliais.

Raktažodžiai: dviratininkai, irkluotojai, aerobinė ištvermė, fizinis išsivystymas, funkcinis pajėgumas, specialus parengtumas, koreliaciniai ryšiai