

Morphofunctional development of young men specializing in canoe slalom during puberty

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Abstract:

The article provides a comprehensive survey of 13–14-year-old boys who engaged in canoe slalom. The most informative indicators were revealed, a rower model was formed, based on morphological and functional indicators and somatotypes. At present, when selecting promising canoe slalom athletes, coaches mainly rely on pedagogical criteria, focus on the speed of mastering rowing techniques, take into account the intensity of the progression of sports results and the levels of formation of specific physical abilities. Physique is one of the most important determinants of success in rowing. The discrepancy between the indices of morphological development and the proper characteristics forces athletes to compensate for this deficiency by forcing the work of other body systems. In conditions of competitive activity, when the athlete's body is in a state of extreme tension of all functional systems, such compensation causes additional waste of energy, which, in turn, leads to a decrease in his reserve capabilities. Our survey of 13 and 14-year-old boys engaged in canoe slalom made it possible to form a certain rower model based on morphological and functional indicators and to determine the somatotypes (constitutional types) of rowers. For canoe slalom, you should select young athletes of taller stature and with a longer body (excess height is provided due to the body length). Canoe slalom athletes should have smaller thigh girth and larger shoulder girth. It was found that the majority of the examined canoe slalom athletes of 13-14 years old were attributed to the average and above average level of morphological development.

Keywords: sports selection, rowing, kayak, morphological and functional indicators

Introduction

The problem of improving sports selection is one of the main theoretical and applied medical and biological problems of physical culture and sports Harwood & Knight, 2015; Holt et al., (2009); Messias et al., (2014). The development of the theory of sports selection affects the level of sports achievements and the development of sports science in general Messias et al., (2018). The goal of sports activity is to achieve the highest possible results for a particular individual Okun, (2016); Serra & Gobatto, (2015). The growth of indicators in most sports, including canoe slalom, requires further search for reliable ways and means of assessing the individual capabilities of athletes Bily et al., (2011); Bonetti & Hopkins, (2010).

In the works of scientists Messias et al., (2015), Okun et al., (2020) it is indicated that the modern level of sports achievements requires the organization of targeted training, the search for more and more effective organizational forms, means and methods of training work, the selection of promising young men and women to replenish the ranks of young qualified athletes. In the theory and methodology of sports training, extensive material has been accumulated on the selection of promising athletes Okun et al., (2020).

At present, when selecting promising canoe slalom athletes, coaches mainly rely on pedagogical criteria, focus on the speed of mastering rowing techniques, take into account the intensity of the progression of sports results and the levels of formation of specific physical abilities Baláš et al., (2020); Okun & Mulyk (2017). These qualities, characteristics and abilities are of a temporary nature and cannot significantly affect the prospects of rowers in their further sports activity Messias et al., (2018); Messias et al., (2015).

In modern conditions of elite sports, the identification of the most gifted, promising athletes is of particular importance Bily et al., (2020); Messias et al., (2017); Macdermid et al., (2019); Sigmund et al., (2016); Vedat, (2012). On the one hand, athletes, differing in their morphological, functional, psychological characteristics, adapt differently to different conditions of activity, on the other hand, purposeful activity influences the selection of the most gifted athletes and the formation of their specific morphological and functional status Okun et al., (2020); Hudson et al., 2019; Rakovac et al., (2011).

Physique is one of the most important determinants of success in rowing. The discrepancy between the indices of morphological development and the proper characteristics forces athletes to compensate for this deficiency by forcing the work of other body Hopkins, (2002); Hunter et al., (2007); Ridge et al., (2007); Messias et al., (2017). In conditions of competitive activity, when the athlete's body is in a state of extreme

tension of all functional systems, such compensation causes additional waste of energy, which, in turn, leads to a decrease in his reserve capabilities Messias et al., (2015); Yoshikawa et al., (2017).

Purpose of the study to form a certain model of a canoe slalom athletes based on morphological and functional indicators and to determine the somatotypes (types of constitution) of canoe slalom athletes' experts.

Material & methods. Canoe slalom athletes 13-14 years old took part in the study. 50 young athletes were examined. Of these, 25 boys are 13 years old and 25 boys are 14 years old.

A comprehensive examination included anthropometric measurements of total, longitudinal, transverse body dimensions, diameters, girths, partial body dimensions (Popescu tests) and analysis of body mass composition components Hunter, (2009); Macdermid & Fink, (2017). The results of the general physical training of young canoe slalom athletes were also analyzed.

The measurement of the longitudinal dimensions of the body was carried out with a Martin anthropometer according to the generally accepted method Hopkins, (2002). The diameters were measured with a large thick compass. The measurement of the girths was carried out with a centimeter tape with a measurement accuracy of up to 1 cm. The body weight was determined using a medical scale with a division value of 50 g. Popescu's tests include measuring arm span (cm), seated torso length, arms up (cm), and seated torso length up to the 7th cervical vertebra (cm). Wrist dynamometry of both hands was also measured using a hand dynamometer (kg) and vital capacity using a spirometer (ml).

According to the measurement results, the average values of morphological and functional indicators and the coefficient of variation were determined. Student's t-criterion was determined by the difference between the arithmetic mean of anthropometric characteristics of young canoe slalom athletes.

When solving the first problem - the selection of the most promising athletes for canoe slalom from among those who do not go in for kayaking, and when assessing a predisposition to engage in this sport, the following anthropometric indicators must first of all be taken into account: body length (cm), arm length (cm), span arms (cm), body length with arms outstretched, sitting (cm) and body length up to the 7th cervical vertebra (cm). The parameters of the total body sizes of 13–14-year-old boys who engaged in canoe slalom are shown in Figure 1.

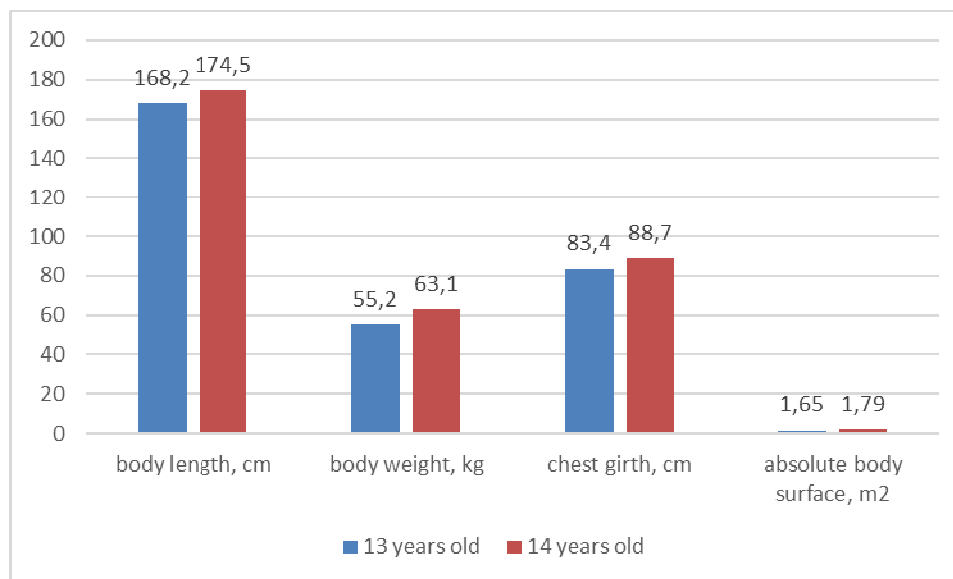


Figure 1. The total size of 13-14-year-old boys engaged in canoe slalom

When comparing the indicators of anthropometric examination, it was revealed that the greatest values of body length were noted in young canoe slalom athletes of 14 years of age ($174,5 \pm 7,35$ cm), in young canoe slalom athletes of 13 years of age, the body length is $168,2 \pm 9,04$ cm. On average, the difference was $6,3 \pm 1,69$ cm. The differences are significantly significant ($p < 0,05$).

It should also be noted that 14-year-old boys in all other total body sizes (body weight (kg), chest girth (cm) and absolute body surface (m²) are superior to 13-year-old boys. The differences between them were statistically significant (body weight $p < 0,05$, chest girth and absolute body surface ($p < 0,01$)).

The analysis of the parameters of the longitudinal and transverse body dimensions of children aged 13–14 years old, who engaged in canoe slalom, is presented in Table 1.

Table 1 Longitudinal and transverse dimensions of the body of 13-14-year-old boys engaged in canoe slalom

№ i/o	Anthropometric indicators	Boys, 13 years old (n=25)		Boys, 14 years old (n=25)	
		\bar{X}	σ	\bar{X}	σ
1	Trunk height, cm	74,5	5,05	78,1	5,21
2	Body length, cm	49,2	3,96	51,0	5,09
3	Arm length, cm	74,9	5,06	78,1	3,92
4	Shoulder length, cm	30,9	2,84	33,0	2,35
5	Forearm length, cm	26,5	2,61	27,1	2,61
6	Leg length, cm	92,7	6,05	95,1	3,95
7	Thigh length, cm	44,8	3,50	46,2	2,96
8	Shin length, cm	40,4	3,17	41,6	2,68
9	Acromial diameter, cm	35,6	2,43	39,1	3,08
10	Pelvis femoral diameter, cm	25,1	1,65	25,9	2,33

Analyzing the data of anthropometric indicators of 13–14-year-old boys engaged in canoe slalom, it should be noted that in all longitudinal and transverse body dimensions, 14-year-old boys were superior to 13-year-old boys. However, the differences between them are significantly significant in the following indicators: body length ($p<0,05$), shoulder width (acromial diameter) ($p<0,001$), arm length ($p<0,05$) and shoulder length ($p<0,01$). The remaining differences in the longitudinal and transverse body dimensions of 14-year-old boys were not statistically significant, since they had a slight advantage over 13-year-old boys.

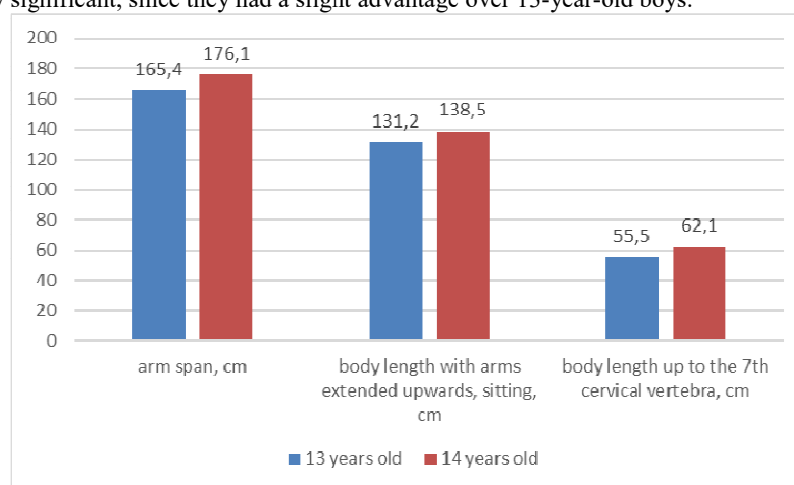


Figure 2. Indicators of anthropometric measurements in boys of 13-14 years of age, in cm (according to O. Popescu's tests)

An analysis of the research results showed that the highest values in arm span were observed for 14-year-old boys ($176,1 \pm 9,30$ cm) and had an advantage over 13-year-old boys ($165,4 \pm 11,29$ cm). On average, the difference was $10,7 \pm 1,99$ cm. Differences are significantly significant ($p<0,01$).

It is necessary to pay attention to the fact that the differences are significantly significant in the length of the body with arms extended upwards, sitting ($p<0,01$) and along the length of the body up to the 7th cervical vertebra ($p<0,001$). Table 2 shows the indices of the composition of body mass components and functional indices in boys of 13-14 years of age, who engaged in canoe slalom.

Table 2 Composition of the components of body weight and functional indicators in boys 13-14 years old, engaged in canoe slalom

№ i/o	Morphofunctional indicators	Boys, 13 years old (n=25)		Boys, 14 years old (n=25)	
		\bar{X}	σ	\bar{X}	σ
1	Fat mass, kg	5,6	2,87	7,1	2,67
2	Fat mass, %	9,9	3,45	11,1	3,86
3	Muscle mass, kg	26,8	6,91	31,9	5,20
4	Muscle mass, %	48,7	3,02	49,9	3,41
5	Bone mass, kg	10,7	2,12	10,8	1,95
6	Bone mass, %	19,6	2,56	17,1	2,79
7	VC, ml	2880,0	602,77	3472,0	816,25
8	Hand dynamometry right hand, kg	19,8	6,88	27,6	9,18
9	Hand dynamometry left hand, kg	18,4	6,60	24,3	8,41

Analysis of body composition data revealed significantly significant differences in absolute muscle mass ($p < 0,01$). The difference averaged 5,1 kg. There were no significant differences in terms of fat and relative muscle mass, that is, the differences were not significant. It should also be noted that 14-year-old boys are inferior in relative bone mass to 13-year-old young canoe slalom athletes. But in terms of absolute bone mass, the advantage remains for young athletes of 14 years old.

When comparing these functional indicators, it was revealed that the highest values of the vital capacity of the lungs were noted in canoe slalom athletes of 14 years of age ($3472,0 \pm 816,25$ ml), in young canoe slalom athletes of 13 years, the value of vital capacity of the lungs is $2880,0 \pm 602,77$ ml. The average difference was $592 \pm 213,48$ ml. The differences are significant ($p < 0,01$).

Statistically significant differences were also revealed in terms of hand dynamometry of the right and left hands ($P < 0,01$). That is, in all functional indicators, boys of 14 years old are superior to boys of 13 years of age. Figure 3 shows the results of general physical fitness (GPP) of 13-14 years old boys.

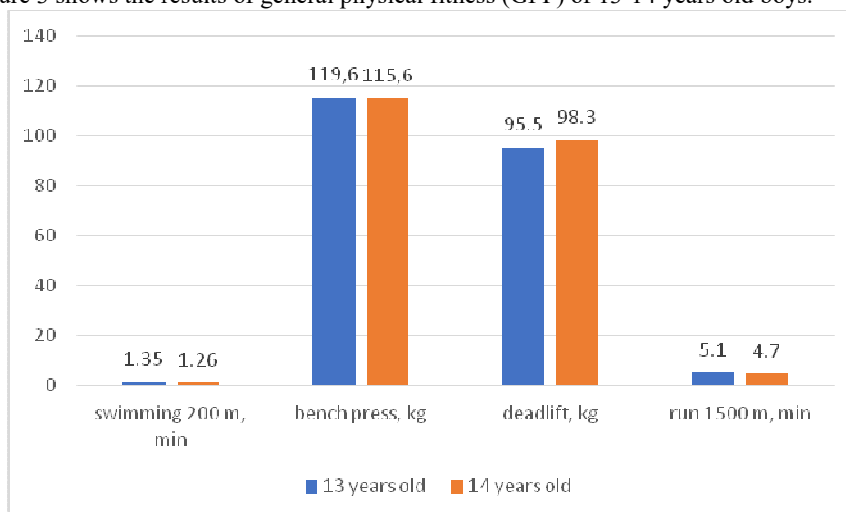


Figure 3. Results of general physical training of 13-14-year-old boys engaged in canoe slalom

The analysis of the results of the general physical training of young canoe slalom athletes showed the advantage of 14-year-old boys in swimming 200 m, deadlift and running 1500 m. However, we did not find statistically significant differences. But in the bench press, boys of 13 years old ($119,6 \pm 18,36$ kg) were slightly stronger than boys of 14 years old ($115,6 \pm 25,92$ kg).

Assessment of the morphological and functional development of canoe slalom athletes was carried out using special scales for assessing the morphological and functional fitness of 13–14 years old boys to rowing according to Mark A. Slavich, Brendan Dwyer, Lisa Rufer (Slavich et al., 2018). The final assessment of the morphofunctional state was calculated as the average score from the sum of the assessments for all signs of the scale.

The distribution of young canoe slalom athletes 13-14 years old by morphological development is shown in Figure 4.

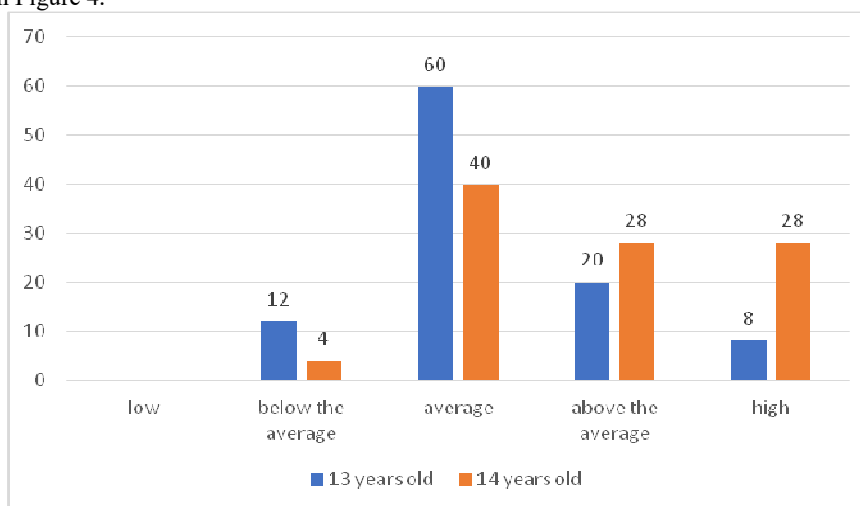


Figure 4. Indicators of morphological development of athletes 13-14 years old, specializing in canoe slalom (%)

Among rowers of 13 years of age, 12,0% belong to below average, 60,0% - to average, 20,0% - to higher average, and 8,0% - to high morphofunctional development.

Among 14-year-old boys, 4,0% refer to below average, 40,0% - to average, 28,0% - to higher average, and 28,0% - to high morphological and functional development.

Conclusions.

Our survey of 13 and 14-year-old boys engaged in canoe slalom made it possible to form a certain rower model based on morphological and functional indicators and to determine the somatotypes (constitutional types) of rowers. The survey of 13 and 14-year-old boys engaged in canoe slalom, allowed to form a kind of rower model based on anthropometric indicators.

Our study confirms the results of scientists Messias et al., (2018); Sigmund, M., et al., (2016); Vedat, A. (2012) that there are also differences between some absolute and relative indicators of the morphological and functional development of boys aged 13–14 years old engaged in canoe slalom, which can be used when conducting sports selection. When selecting, you can also use relative indicators of morphological development: kayakers should have a greater ratio of body length to the length of the upper and lower limbs. For canoe slalom, you should select young athletes of taller stature and with a longer body (excess height is provided due to the body length). Canoe slalom athletes should have smaller thigh girth and larger shoulder girth.

There are differences between some absolute and relative indicators of morphofunctional development of 13–14 year old canoe slalom athletes, which can be used for sports selection. Kayakers should have a greater ratio of body length to the length of the upper and lower extremities, which is also important in sports selection.

As an informative criterion for assessing young athletes in the selection in canoe slalom, it is advisable to use Popescu tests, which allow to determine the main parameters of a person. These include body length, torso and arm length, arm span, as well as for kayakers (sitting body length with arms outstretched) and for canoeists (kneeling body length with arms outstretched).

It was found that the majority of the examined canoe slalom athletes of 13-14 years old were attributed to the average and above average level of morphological development.

The model characteristics developed by us can be use for selection and sports orientation in canoe slalom at various stages of training and monitoring the dynamics of the morphofunctional state in the annual cycle of training. Conflict of interests. The authors declare that no conflict of interest, which can be perceived so that it can harm the impartiality of the article. Financing sources. This article didn't get the financial support from the state, public or commercial organization

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