Age dynamics of the maximum alactate power of highly qualified hockey players

UDC 796.355.093.582

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Abstract

Objective of the study was to evaluate the dynamics of maximum alactic power (MAP) as the main indicator of the speed-strength fitness of hockey players and to identify its relationship with the age of athletes.

Methods and structure of the study. The work was carried out on the example of hockey players (n=11, field hockey), who underwent regular testing for 14 years. To assess this indicator in laboratory studies, a modified Wengate test was used.

Results and conclusions. Testing of the index of maximum alactic power (MAP) of highly qualified field hockey players conducted over 14 years allows us to speak about the dynamics of an increase in the level of speed-strength fitness of the muscles of the lower extremities in the process of ontogenesis in all the studied athletes, which is confirmed by the results of regression (an increase in R2 from 0.51 to 0.80) and correlation (p<0.01) analyses.

Adequate construction of the training process for athletes under the age of 40 contributes to an increase in the indicator of maximum alactic power.

Keywords: *field hockey, maximum alactic power, athlete's age.*

Introduction. In most team sports, to achieve high results, the manifestation of functional capabilities is required: maximum alactic power, maximum oxygen consumption at the level of aerobic and anaerobic thresholds, and other indicators [2, 4]. Studies of the indicator of the maximum alactic power of athletes using the Wengate test are widely used in the practice of elite sports [1, 3, 5]. But, unfortunately, these studies are carried out sporadically.

Objective of the study was to evaluate the dynamics of maximum alactic power (MAP) as the main indicator of the speed-strength fitness of hockey players and to identify its relationship with the age of athletes.

Methods and structure of the study. In the period from 2004 to 2017, 19 laboratory examinations were conducted, in which 80 hockey players with qualifications from the first sports category to the international class master of sports took part. We selected athletes who passed at least 10 tests (Table 1). Among 11 athletes - eight masters of sports of Russia of international class and three masters of sports of the Russian Federation.

Testing was carried out at various stages of the annual training cycle in the laboratory of fundamental problems of the theory of physical and technical training of the Russian State University of Physical Culture (RSUPESY&T) from 2004 to 2007, and from 2008 to 2017 - in the research laboratory "Information Technologies in Sports" Moscow Institute of Physics and Technology (MIPT). The standardization of studies for 14 years was fully respected.

Functional testing methodology: The subjects performed two tests in succession. First step test on the Monark 894 Peak Bike. Heart rate (HR) and pulmonary ventilation (PV) were recorded, exhaled air was sampled and analyzed using a METAMAX (Cortex) device made in Germany. The power of aerobic and anaerobic thresholds (AeT, AnT), as well as oxygen consumption (OC) and heart rate were estimated by changing the rate of pulmonary ventilation and the respiratory coefficient. The indicators of maximum oxygen consumption (MOC) and potential maximum possible oxygen consumption (MOC), oxygen consumption at the level of AeP and AnP were calculated. Then, after recovery (3–5 min), the main test was performed to determine the maximum alactic power (MAP) in the form of sprint acceleration on the same bicycle ergometer (a variant of the Wengate test). The load for hockey players was determined taking into account body weight: Load (Newtons) = 0.9 body weight. The hockey player without load starts pedaling, trying to gradually increase the pace. The load is gradually added. When the rate of 80-90 rpm is reached, the subject is given a command and the maximum load for this athlete is set. After that, the subject must pedal as quickly as possible in order to show the maximum pace in the range of 130-150 rpm in 5-7 s, and as soon as the pace starts to decrease, the test stops. In this case, the maximum values of the rate and power are fixed, which is defined as the maximum alactic power (MAP).

Methods of mathematical statistics: Standard methods of statistical data processing were used: determination of the sample mean (M), standard deviation (Ϭ) and coefficient of variation (V%). Linear regression and correlation analysis made it possible to evaluate the relationship between parameters by calculating the Pearson correlation coefficient. All processing was carried out in an Excel spreadsheet environment. In the same place, scatter diagrams were constructed, which displayed the dependence of the index of maximum alactic power (MAP) on age for each of the subjects with the calculation of the regression equation for this dependence and the coefficient of determination R2.

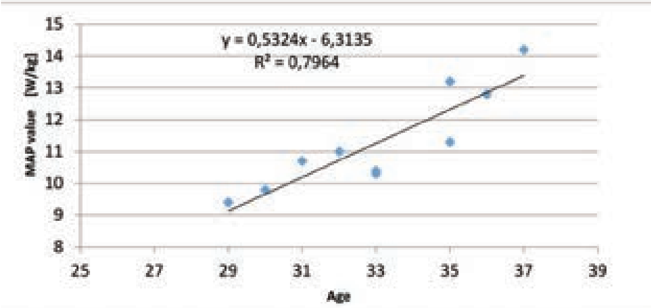
Results of the study and their discussion. The results of a linear regression analysis between the independent variable - the athlete's age (predictor) and the dependent variable - the indicator of maximum alactic power (MAP, W/kg) are presented in the form of scatter plots, an example is shown in fig. 1. In parentheses is the age of the subject at the time of the last examination. In all cases, we see a trend towards a linear increase in the values of the MAM variable, depending on the increase in the age of the athlete. The values of the obtained R2 values from 0.51 (Zhi-ov, 34 years old) to 0.80 (Lo-ov,

Table 1. *Age, role, terms of stay in the team of hockey players who have passed 10 or more tests*

Player	Age at first examination	Role	Length of time on the team, years	Number of examinations
Che-ov	17	Defender	2004-2016	18
Lo-ov	17	Defender	2004-1017	17
Go-ov	17	Midfielder	2004-2017	16
Mo-ov	20	Defender	2004-2017	15
Az-ov	18	Forward	2004-2017	14
La-ov	16	Defender	2004-2017	14
Zhi-ov	20	Forward	2004-2017	12
Ku-ev	15	Defender	2006-2017	11
Pl-ov	30	Forward	2004-2011	10
Ma-in	23	Forward	2004-2010	10
Go-ev	16	Forward	2006-2011	10

Table 2. *Results of correlation and regression analysis of the dependence of the maximum alactic power on the age of the athlete*

Sportsman	Average age, years	Athlete's age at the end of the study period, years	Average MAP value (W/kg) M± Ϭ	Pearson correlation coefficient	Bilateral correlation. level significance:	Regression coefficient, R^2
Pl-ov	33.1	43	11.3±1.58	**0,892**	< **0,01**	0,796
Ma-in	26,1	36	12,3±1,14	**0,806**	< **0,01**	0,649
Zhi-ov	25,5	34	12,7±1,53	**0,718**	< **0,01**	0,515
Mo-ov	27,5	34	14,6±1,81	**0,787**	< **0,01**	0,618
Az-ov	25,3	32	12,7±1,79	**0,859**	< **0,01**	0,738
Lo-ov	25,5	30	12,7±1,53	**0,820**	< **0,01**	0,672
Go-ov	22,2	30	14,6±1,85	**0,816**	< **0,01**	0,665
Che-ov	22,9	30	13,6±1,16	**0,825**	< **0,01**	0,680
La-ov	22,3	29	13,6±1,67	**0,895**	< **0,01**	0,800
Go-ev	18,8	27	13,7±1,24	**0,864**	< **0,01**	0,750
Ku-ev	19,7	25	13,4±1,44	**0,864**	< **0,01**	0,751



The results of a linear regression analysis between the independent variable-athlete age (predictor) and the dependent variable, Pl-ov, 43 years old

29 years old) indicate a fairly good approximation of the MAP dependence on the age of the athletes. The coefficients in the presented linear regression equations are statistically significant at p<0.05 and above.

To confirm the trend of dependence of the increase in MAP with the age of hockey players, we conducted a Pearson correlation analysis. The results of the correlation analysis and some statistical values are presented in Table 2.

The results of the correlation analysis showed a close relationship between the growth dynamics of the desired indicators, with a high degree of reliability p<0.01 for all athletes. The initial age differences of the studied athletes from 15 to 30 years (Table 1) and various individual relative values of MAP from 11.3±1.58 to 14.6±1.85 W/kg (Table 2) for the dynamics of the results of the increase in speed -strength abilities had no effect. We have found that with age, the athlete increases the speed-strength readiness of the muscles of the lower extremities. It can be assumed that this relates to the strength component to a greater extent, due to the number of recruited muscle fibers, the number of myofibrils, and the average ATPase activity of myosin in them [6].

Presented in table 2 values of R2 in a paired linear relationship can be interpreted as coefficients of determination, which characterize the share of change in one of the indicators when the other changes. Therefore, in our case, it can be argued that changes in the age of athletes by more than 0.5 (50%) determine changes in MAP indicators. That is, an adequate construction of the training process for athletes under the age of 40 contributes to an increase in the indicator of maximum alactic power (MAP).

Conclusions. Testing of the index of maximum alactic power of highly qualified field hockey players conducted over 14 years allows us to speak about the dynamics of an increase in the level of speed-strength fitness of the muscles of the lower extremities in the process of ontogenesis in all the studied athletes, which is confirmed by the results of regression (an increase in R2 from 0.51 to 0.80) and correlation (p<0.01) analyses.

The initial age of the studied athletes was 15-30 years and the individual relative MAP values of hockey players of various roles during the first tests did not affect the subsequent dynamics of the results of the increase in speed-strength abilities.

Adequate construction of the training process for athletes under the age of 40 contributes to an increase in the indicator of maximum alactic power.

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Anticipation as a conscious acceleration of response time under conditions of initiative and counteraction with the enemy

UDC 796.01:159.9

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Abstract

Objective of the study was to consider the effect of anticipation on the performance of certain mental functions aimed at: reducing the response time to the enemy's influences; to reduce the time for the use of combat actions (methods) due to earlier determination of the moment of the start of an attack and automation of responses to a trigger signal.

Methods and structure of the study. The study of the influence of ideomotor representations of the performance of deliberate combat actions led to the understanding of anticipation as a phenomenon characteristic of almost all mental processes of controlling motor actions. Anticipation allows, before the appearance of a favorable situation or a pre-launch and trigger signal, to already carry out mental and motor preparation for combat.

Results and conclusions. As a result of the use of impromptu combat actions, anticipation makes it possible to reduce the time of the launch reaction to enemy actions, to change the temporal structure and duration of mental processes that accompany the response in combat (competitive) countermeasures. Understanding the patterns of controlling the speed of one's own reactions in combat interaction allows the athlete to respond most quickly to the trigger signal.

Keywords: *anticipation, self-order, starting reaction, moment of attack start, anticipation, pre-launch and starting signal.*

Introduction. The concept of anticipation as a mental function of the brain found its justification in the works of N.A. Bernstein as a model of the required future and in the works of A.K. Anokhin as an acceptor of the result of an action.

Anticipation is an anticipatory projection of situations and actions and, accordingly, all mental functions associated both with the acceleration of "self-order" (a conscious trigger command) to apply actions, and with the performance of response actions on a trigger signal.

Anticipation acts as a universal brain function that allows an athlete in conflict interaction with an opponent to anticipate his actions with some lead in time before they are performed [2, 4]. The manifestation of anticipation in psychomotor actions (by analogy with reactions that are response actions, psychomotor actions are opposite to them and are initiative actions) allows the athlete to anticipate not only the impact of the opponent, but also mentally unfold his intentions in the future, which, in fact, is the initial problem timing research in the field of accelerating arbitrary response in conflict situations. In the process of improvement, timing is automated and applied both intuitively and consciously when solving mental problems in micro time intervals [3].

Under timing (from English timing - timing - timing; timing; regulation) in martial arts, we understand the