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BIOPEDAGOGY IN THE PREPARATION OF ATHLETES

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Abstract - The article deals with the development of pedagogy because of its synergy with other sciences. By the direction of "Biopedagogy" as a logical successor of sport pedagogy is presented. Some of the achievements of biopedagogy in recent years are showed. The use in the preparation of today's athletes - namely, ECG and bioimpedance monitoring, dietary supplements, and lactate biosensors, genetic predisposition, music promotion, etc are promoted.

Keywords: biopedagogy, fatigue, ECG, lactate, biosensors, the preparation of athletes, dietary supplements.

Athlete's training - part of the education of the person using the exercise. The main purpose of which is to improve the functionality of the organism resistant. It can be achieved through regular, long and tedious exercise. But sports training can lead to fatigue, overtraining and impairments. Determine the duration and intensity of the training process – it's a responsibility of the coach. But in the information received by the coach during training, there is a drawback - it is subjective. [8] The coach's evaluation of the learning process can be generalized and often not accurate. For this reason, there is a need to change the approach to pedagogy of sports activities.

The complexity of managing sports training is that we're trying to work on a self-regulating complex system (the body). And of course, we get various reactions to the same effect, due to individual psycho-physiological characteristics of the organism. This means that the same exercise can give a different training effect.

Sports training - a multi-year adjustment to the sport. Adaptation to the environment can go in two separate ways - overcoming obstacles and avoiding

them. Overcoming obstacles - a biological component. Obstacle avoidance based on experience - educational component. Synergetics (from the Greek. Synergeia - cooperation, aiding, abetting) of biology and pedagogy creates a highly efficient biopedagogy sport process.

But the union only biology and pedagogy is not the whole biopedagogy. A new research area should deal with the study of the processes of human life, based on the achievement of other sciences to apply that knowledge in biopedagogy. Breeding ground for biopedagogy are - biology, education, sports medicine, physiology, anatomy, biochemistry, biophysics, biomechanics, food chemistry, psychophysiology, fluid dynamics, physics, robotics, electronics, and many other sciences in all their manifestations.

The first official statement of the term "biopedagogy" was made at a conference in Malahovka in 1991. [13]. Participants hailed the new term and its definition, and then in 1992, the first book in this area, "Biopedagogy or sports training" [14].

The founder of byopedagogy is considered Ph.D. in pedagogy Professor Alexander Ivanovich Zavyalov. Studies have shown that the cavity pericardium that surrounds the heart is a major mechanism for ensuring the effective filling other 4 cells throughout the cardiac cycle [5], i.e. the heart is the 5-chamber system. He created "Classification of electrocardiogram changes in muscle load in a healthy person" [12] led to the ability to accurately determine the fatigue of athletes during training and dispensing exercise. Using ECG during the training process allowed Zavyalov and colleagues to prepare such athletes as B.Saytiev (3 times Olympic champion), Alexander Kurlovich (2x fold Olympic champion) and several Olympians Krasnoyarsk winners and Olympic champions in 1996, 2000 and 2008 year.

Biopedagogy in the narrow sense for the sport - *the rational combination of teaching and the impact of biological control to maximize the training effect without affecting the health of athletes.*

Table 1

ECG changes in scores in the long recovery period, depending on the fatigue caused by the physical education and sports.

Points	Rating
0	No deviations
	Decreased S-T segment by obliquely upward type (line segment smoothly enters from S wave to T wave):
1	0.1 mV not more than 50% of the reported complexes;
2	0.1 mV, more than 50%;
3	0.2 mV, not more than 50%;
4	0.2 mV, more than 50% for the complexes.
	Segment (R) S-T increased above the isoline:
5	mV than 0.1 but not more than 50%
6	is more than 50% for the complexes.
	Reduced more than 0.1 mV S-T segment of ischemic (there is a horizontal section):
7	is not more than 50%;
8	more than 50% of the complexes
9	T waves up to 0.1 mV
10	T waves up to 0.1 mV combined with ischemic segments of the S-T
11	A negative T wave
12	Have any of the ECG abnormalities.

Table 2

ECG changes in scores depending on fatigue during exercise

Points	Rating of ECG during muscular work (estimated ≥ 10 complexes)
	Interval is shortened, and disappears T – P interval. T, U, P waves merge on the two-and onehump type, obliquely upward segment of the S-T moves down from the isoline, R wave amplitude decreases and deepened wave S, however, $R > S$, shorter intervals R-R, while the heart rate up:
13	100–120 bpm
14	121–140 bpm
15	141–160 bpm
16	161–180 bpm
17	181–200 bpm
18	свыше 200 bpm.
19	$S > R$ - pronounced decrease in R and S recess
20	S-T segments ischemic type is not more than 20%
21	S-T segments ischemic type more than 20% to 50%
22	"Plateau" on the T wave less than 50% of complexes

23	S-T segments ischemic type to 50% and a "plateau" in the T-wave in less than 50% of complexes
24	"Plateau" on the T wave in more than 50% of the complexes
25	Segments S-T ischemic type to 50% and a "plateau" in the T-wave by more than 50% complexes
26	Segments S-T ischemic type 50% to 80%
27	"Plateau" and ischemic segments S-T for more than 50% to 80% of registered complexes
28	Segments S-T ischemic type than 80%
29	Segments of the S-T ischemic type in more than 80% of registered complexes combined with a "plateau"
30	Extrasystole against the tachycardia
31	The appearance of complexes with negative or 2-phase T waves (after load disappear after a few seconds);
32	Negative or 2-phase T wave after the load is held for long time
33	The broadening of the QRS greater than 0.1 s
34	The broadening of the QRS greater than 0.1 with a negative or 2-phase of the T wave
35	The presence of any ECG abnormalities

ECG was recorded before exercise, every athlete in lead DG5 (bipolar breast), which corresponds to the V5 according to Wilson. If the ECG at rest is 7 points or more (Table 1), the athletes go to the doctor and are not allowed to exercise. During the training, the ECG recorded during the breaks between training exercises and when the respective athlete's status came it means the end of training (Table 2).

Based on the research that we conducted, revealed that the greatest effect of acute exercise brings fatigue to 26-28 points [8, p 353].

The important characteristic is the weight of the athlete (especially in the martial arts). At the same time, the weight of the body - an integral characteristic and makes it impossible to monitor the actual state of the athlete according to the study of TF Abramova (1993). Realistic changes can be observed in the level of muscle and fat part of the body, which indicates the activity of protein synthesis and energy metabolism [10]. For example, a low level of muscular athlete component may indicate a low level of protein synthesis and decreased muscle mass in the dynamics of a lack of energy resources, over-training and inadequate recovery (inhibition of protein synthesis). [2] Elevated levels of the fat component may indicate a decreased activity of lipid metabolism, reduced total energy potential and generally on the lower body's readiness to perform intensive and

high-volume training work [10]. Table 3 shows the algorithm for monitoring the nature of the athlete changes in muscle and fat component of the TF Abramova (2004) [2].

Table 3

The dynamics of labile components of body weight and the pattern of the training load.

MBM dynamics	FBM dynamics	Pattern of the training load
+	+	The training load is not enough. Need a period of rest
+	const	Const training load of mostly power pattern, the total volume is medium, insufficient amount of aerobic work. Possible failure of adaptation as not trained in the use of energy lipid substrate
+	-	Developmental pattern of the training load, when the individual is extremely high values of muscle mass and extremely low levels of fat. Attention should be paid to an adequate amount of compensatory work while reducing the total amount of work
const	+	Training load is insufficient. Requires an increase in the total amount of work in a high proportion of the aerobic component, followed by the addition of power loads
const	const	Training load supporting character, balanced, does not lead to the creation of a new adaptive framework
const	-	Training load supporting character with an emphasis aerobic
-	const	Inadequate training load: high volume intensity (anaerobic) of unbalanced sufficient compensatory work. Subsequently the power component is to be added
-	+	Inadequate training load: a high total volume at a high excess of anaerobic work and lack of compensatory work. It is necessary to reduce the total amount of work.
-	-	Inadequate training load: a high volume of aerobic and anaerobic component. Overtraining. Should appoint a recovery period; reduce the total amount of work.

Also, it is worth noting the work in this direction of Martirosov EG [6]. Figure 1a shows the typical trends of composition of the body, according to kaliperometry corresponding optimal tactics athlete training for a competition in which the muscle mass (top graph) monotonically increases to 54-56%, and body fat mass (bottom graph) monotonically decreases to 7 -9%. Two other figures illustrate inefficient modes of preparation. Figure 1b corresponds to a situation of over-training athletes before competition. Dynamics of changes in body composition in Figure 1 displays the lack of functional training immediately before

the competition. Perhaps, athlete overly paid attention to special training at the expense of the general physical.

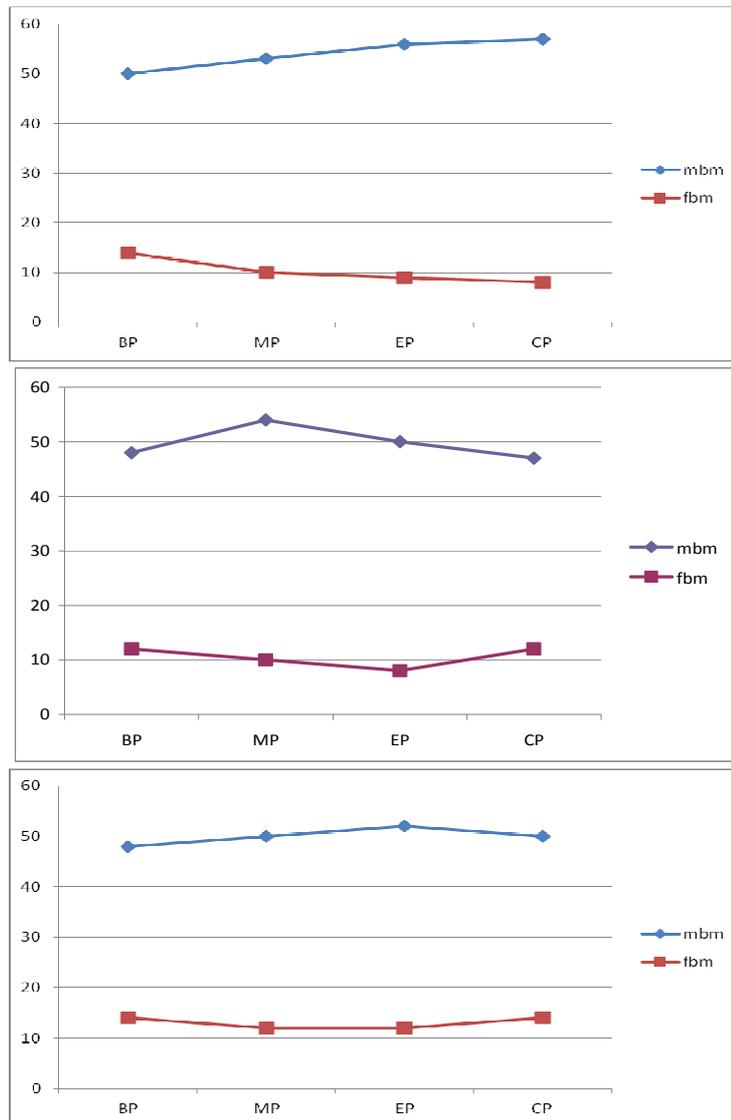


Figure 1, 2, 3 Variants of the dynamics of changes in body composition of athletes training cycle: 1 - a positive trend, 2 - negative changes, acute overexertion 3 - lack of general physical fitness. Legend: MBM%, FBM% - the percentage of fat and skeletal muscle mass, BP, MP, EP - beginning, middle and end of the preparatory phase. BC and EC - the beginning and the end of the competition



Figure 2. Bioimpedance analyzer from Tanita (Japan)

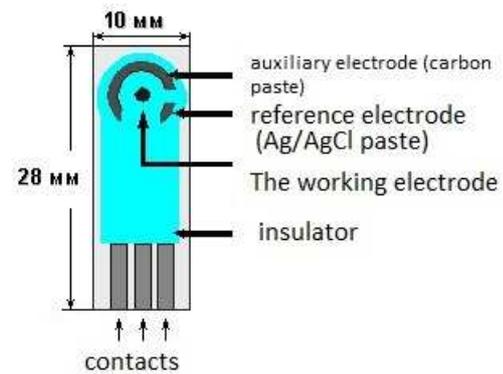


Figure 3. Biosensors for the determination of lactate.

At the same time proved the influence of protein dietary supplements (PDS) on the human body [9]. We offer a high-protein diet to follow and apply the protein cocktails and biologically active amino acid complexes to keep the ratio "muscle body mass / fat mass of the body" (MBM / FMB) at the maximum level in the direction of the MBM [2]. The use of protein supplements can be attributed by difficult to obtain a high dose of protein from normal food, the faster the protein digestibility of the cocktail and the absence of harmful (in terms of increased cholesterol levels) of animal fat in a cocktail inherent foods rich in protein (pork, eggs). Loss of MBM is more time and energy-consuming than the loss of water associated with the dehydration, so to reduce the weight of the athlete, there is a need to maintain a high-protein diet for 1 to several months, depending on the estimated mass loss (EML).

We propose to use whey protein before exercise and immediately after exercise, as it dramatically increases protein synthesis in the body [3]. It is also possible protein intake in the morning, on an empty stomach, after waking up. The use of whey protein before exercise will prevent the collapse of the MBM in training, and, possibly, to increase the energy level of the athlete. The use of whey protein after exercise can be used to reduce the catabolic effects of MBM. It is also helpful to receipt casein protein at night to prevent collapse overnight muscle tissue as it increases protein synthesis for a long time [3].

As the monitoring of labile components of body weight, we offer modern methods of biological control, namely bioelectric methods [6]. The first reference that refers to the works of W. Thomson (1880), and in consequence associated with such scientists as G. Frike, K. Cole, H. Schwan, BN Tarusov and others. Very good in showing themselves are bioimpedance analyzers from Tanita (Japan). In particular, they are used in many studies of the Center for Biomedical Research in Irkutsk Irkutsk Technical University under the direction of MD Witold Leonardovich Sivohov [10].

Based on the foregoing, it can be concluded that there was insufficient or danger with only pedagogical influences on the regulation of body weight. It should be said about the necessity of using dietary supplements as biological effects on the martial arts sportsmen at various stages of preparation, namely the use of whey and casein protein shakes and amino acid complexes. Together with the timely monitoring of the athlete's state can adjust the size of labile components in the dynamics, thereby improving the training effect.

We are convinced that the uses of the synergetic approach of biology and pedagogy in this matter allow you to:

- Improve boost overall fitness combat sports, weight gain athlete
- Increase muscle component of the athlete, without increasing the overall weight of the combat sports, saving weight category
- Reduce weight of the sportsmen to go to a lower weight class, with a slight decrease of muscle mass (by reducing the fat component)
- Improvement of compensatory work, improved recovery, overall health, and even the immune system of sportsmen.

Look promising study of lactate in the body of an athlete at different stages of training and competition with modern biosensors. New research and discoveries in this area can help in organizing a more effective sports training [5].

It is worth noting the work on the analysis of the training process in terms of lactate level by P. Janson [4]. The concentration of lactate (lactic acid) in the blood is an important indicator that can serve as a criterion for evaluating the intensity of

exercise. A lactate level in the blood is measured in millimoles per liter of blood lactate. At rest, a healthy person lactate concentration of 2.1 mmol / l. After vigorous physical activities this number rises. Even a relatively small increase in lactate concentrations (6-8 mmol / L) may degrade coordination of athlete. Regularly high lactate level can decrease the athlete's aerobic capacity [4].

Biosensors using the "Prussian Blue" [5] can not only help in further studies, but also in the management of training activities.

Not to mention the study of the influence of music on the human body. The influence of music on the human body proved a lot of work in music psychology and music therapy (Dogel IM, 1888 Mognedovich MR, 1966 Shushardjan SV, 2005). Psychophysicologists (Kalyuzhnyi LV, Klassin SY) revealed the influence of music on the neuroendocrine function, in particular - to the level of hormones in the blood, which play an important role in emotional reactions. Consequently, it is possible to use new methods of training, exercises and sports impact on combat sports with the use of music.

It is advisable to selected music has a positive effect on human activities by setting such rhythmic organism activity in which physiological processes are the most effective [11, pp. 92]. Music has a significant impact on the minute volume of blood, heart rate, blood pressure, blood sugar levels, and it can increase and decrease muscle tone [8].

We propose to use music as an additional stimulus during training anaerobic energy system of combat sports, the ability to replenish ATP and athlete's resistance for acidosis (improving performance with an increase of lactate).

Biopedagogy has not been without genetics. Many studies have demonstrated the ability to predict certain qualities of sportsmanship and growth of the individual in certain sports. [1] And even determine the direction for the development of the individual within the contiguous (similar) sports

Between representatives of the standard sports and combat sports athletes were obtained significant differences on a number of parameters, which are not only differentiating, but also to a large extent genetically controlled. Such features

which can be used for prediction in a generic orientation (by MS Bril, 1980, 1988) are shown in Table 4.

Table 4

Predictive genetic criteria for the initial differentiation of the children into groups of standard sports and martial arts

Differentiating Criteria	Different kind of martial arts	Students t-test	Significant, p
First-born people	Taekwondo	2.41	0.05
Relatives - "standart" sportsmens	Boxing	2.69	0.05
Relatives - "standart" sportsmens	Boxing	5.25	0.001
Relatives are engaged in Ph. culture	Kickboxing	3.00	0.05
Relatives are engaged in Ph. culture	Taekwondo	3.00	0.01
Blood group I(0)	Boxing	3.26	0.01
Blood group I(0)	Kickboxing	2.56	0.05
Blood group II(A)	Boxing	2.96	0.01
Blood group II(A)	Taekwondo	2.80	0.01
Blood group III(B)	Taekwondo	2.12	0.05
Blood group IV(AB)	Taekwondo	2.40	0.05
The predominance of curls in dermatoglyphics	Taekwondo	4.7	0.001
Left hand is leading	Taekwondo	2.61	0.05
One-sided type of dominance	Kickboxing	2.15	0.05

To summarize, we can say that biopedagogy is the logical next step in the development and pedagogy of sport. And in practical physical education, certain methods of biopedagogy are already applied, bringing us a great athlete, very often the Olympic champions and prize-winners.

But we need to systematize the knowledge of biopedagogy to release teaching and learning materials, and to begin the preparation of new professionals in the field of sports training, athletes who can bring the sport in Russian Federation to the highest level. Thus, it is likely to increase the number of Olympians.

Naturally, there is a need for further study biopedagogy, researching and development of new methods of training process in sports.

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