

## Influence of carbohydrate gel “Energel. Endurance” on athlete’s workability

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### Abstract

**Purpose:** to study influence of carbohydrate course application on qualified athlete’s special workability.

**Material:** workability of cyclic kinds of sports athlete (n=14) was determined before and after gel course application under increasing loads.

**Results:** confident increase of work power was found at threshold of anaerobic metabolism (by 12%). Besides, rising of mechanic effectiveness and economy of muscular work at threshold of anaerobic metabolism and at maximal oxygen consumption was registered. Such results witness about presence of conditions for improvement of muscular energy supply at the account o aerobic component that permits to prolong working time without fatigue.

**Conclusions:** purposefulness of carbohydrate gel application in conditions of physical loads, requiring endurance, has been proved. Its application in athlete’s training is recommended for increase of training and competition effectiveness.

**Keywords:** athlete, products of special purpose, endurance, workability.

### Introduction

The problem of effectiveness rising in elite sports’ training and competition functioning nowadays has acquired especial importance in connection with rapid growth of sport results, further increase of rivalry at international sport arena, constantly increasing physical loads. The main methods of its solution are optimization of training and competition loads, psychological training, rational working, rest and eating regimes. Besides, it implies creation of conditions, under which physical loads volumes would guaranty the best sport results for sportsman [7, 8, 19, 20].

Alongside with these methods still more important role is played by auxiliary factors of physical workability improvement. They are special food products, which contain biologically active substances and are not related to doping.

For sustaining high sport workability organism shall be supplied with food substances in proper and optimal for their assimilation quantity and proportions. Athlete’s demand in energy and food substances depends on intensity of metabolic processes, which take place in organism under physical load [4, 10, 14].

As on to day, it is undoubted that athlete’s eating shall include special food products. It is known that sustaining and recreation of main metabolic functions’ workability under highly intensive and prolonged training and competition loads is not always possible only with traditional food. One of reasons of this can be daily diet of big volume. It weakens food assimilation in organism. Including of highly calorific special food products in main eating regime permits the following: to operatively correct athlete’s eating; to provide organism with energy and food substances in proportion to energy consumption. Such approach facilitates sustaining of high

workability and readiness for physical loads in conditions of repeated trainings [4, 8, 17, 18]. In other works effective mechanisms of athlete organisms’ bio-chemical adaptation to competition loads were shown [12, 22].

In connection with the above mentioned studies in the field of new special food products and their influence on physical workability become relevant and promising. Scientists worked out and implemented in practice food product which contains amber and apple acids,  $\beta$ -alanine, sodium, potassium, magnesium and ascorbic acid. Logical continuation of such studies [2, 5, 6] was determination of carbohydrate gel influence on physical workability. Determination of elite sportswomen’s anaerobic efficiency is of great importance [16]. Among approaches to increase of athlete’s workability we can mark out application of special ergogenic means, which permits for athlete to freely breathe and do not influence negatively on efficiency [11]. Such approach proves their application’s purposefulness for efficiency rising [21, 23]. It can also increase athlete’s physical endurance [26]. Determination of connection between eating and its adequacy is of not less importance [24, 27, 28]. It should be noted that insufficient quantity of macro and micro elements in food can reduce physical workability and increase risk of diseases [15].

*Hypothesis:* it was assumed that new, permitted (not containing doping) ergogenic factors can facilitate elite athlete’s training and competition functioning. Such factor’ application shall consider specific features of kind of sports and training period. Such approaches can ensure optimization of athlete’s functional state and facilitate complete realization of their potentials in Olympic and Para-Olympic Games.

*The purpose of the research:* to study influence of carbohydrate “Energel. Endurance” course application on qualified athlete’s special workability.

## Material and methods

**Participants:** in the research athlete- academic rowers participated - men: 18-25 yrs age; body height  $191.3 \pm 5.59$  cm; body mass  $82.9 \pm 9.8$  kg. Their qualifications were: first sport category (n=6); candidate masters of sports (n=6); masters of sports (n=2). As on the start of researches, according to the data of prophylactic medical examinations all athlete were practically healthy. The athlete were instructed about purpose, procedures and potential risks of the research. All athlete gave written consent for participation in the research. They were divided into two homogenous groups, 7 persons in each.

**Procedure:** the research was carried out on general stage of preparatory period of annual cycle. The research took two micro cycles (10 days). During this period athlete used "Energel. Endurance", two bags every day according to the following scheme: 1 bag 20-30 minutes before training loads with sufficient quantity of water.

Testing was fulfilled with the help of ergo meter Monark Ergomic 894. The testing procedure envisaged continuously increasing loading with constant pedals' rotation frequency of  $-60 \text{ rpm}^{-1}$ . Initial power was 58.8 W. Then, load increased by 0.3 kg every 3 minutes. It corresponded to increase of power by 17.6 W. The work was fulfilled up to reaching maximal oxygen consumption. Total testing time, considering warming up was from 43 to 53 minutes (see fig. 1).

In the testing we used gas analyzer "Oxycon Mobil", produced by "Jeager" (Germany) and pulse meters (Polar S810i, produced by "Polar" (Finland). In the process of testing the following indicators were registered with discreteness of 10 seconds: oxygen consumption (OC,  $\text{ml} \cdot \text{min}^{-1}$ ;  $\text{ml} \cdot \text{min}^{-1} \cdot \text{kg}^{-1}$ ), maximal oxygen consumption (MOC,  $\text{ml} \cdot \text{min}^{-1}$ ;  $\text{ml} \cdot \text{min}^{-1} \cdot \text{kg}^{-1}$ ), heart beats rate (HBR,  $\text{bpm}^{-1}$ ), minute volume of breathing ( $\text{l} \cdot \text{min}^{-1}$  and  $\text{l} \cdot \text{min}^{-1} \cdot \text{kg}^{-1}$ ), release of carbon dioxide ( $\text{CO}_2$ ,  $\text{ml} \cdot \text{min}^{-1}$ ). Mechanical effectiveness was determined as relation of work power to

oxygen consumption and expressed in percents (W/OC, %). Economy of work was defined as relation of oxygen consumption to work power and expressed in percents (OC/W, %).

Lactate concentration in athlete's blood was registered with bio-chemical analyzer LP-400, produced by "Dr. Lange" (Germany) with the help of standard agents, produced by the same company.

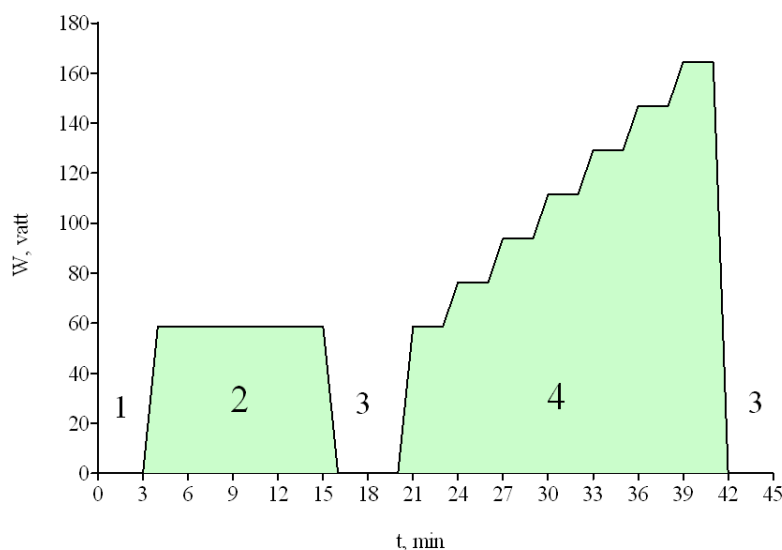
Anaerobic threshold (AnT) was found by emersion of VentilationThreshold, VT – the moment of ventilation equivalent increase by oxygen  $\text{VE}/\text{VO}_2$ ) and lactate threshold LT – sharp rising of lactate concentration in blood [20].

These tests were carried out at the beginning and at the end of the research.

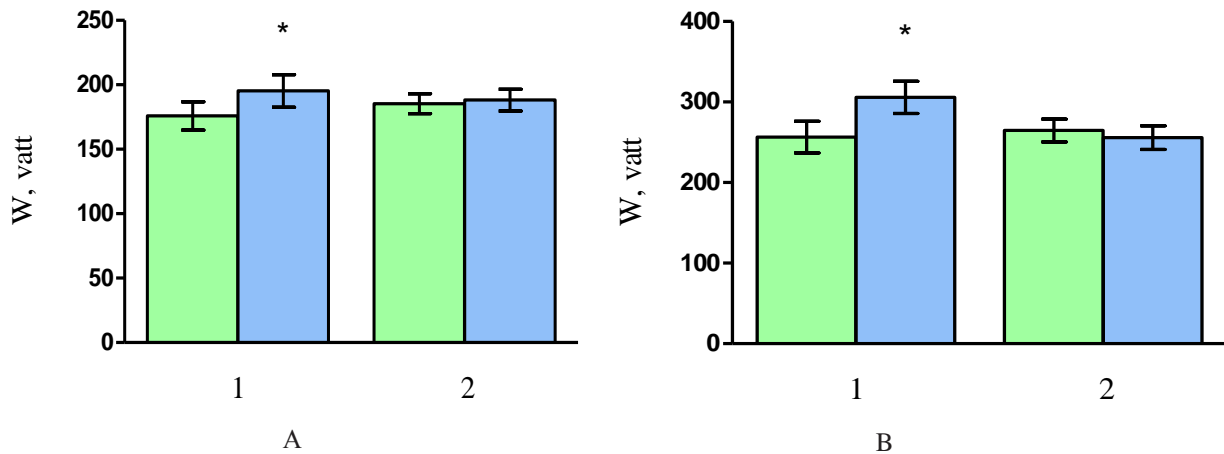
**Statistical analysis:** was fulfilled with the help of programs "GraphPad Prism version 5.00 for Windows" (GraphPad software Inc.,USA). Confidence of differences was determined by non parametrical statistic (Wilcoxon's iconic test). Value  $p \leq 0.05$  was taken as confident.

## Results

By results of the research we found positive influence of course application of "Energel. Endurance" on athlete's aerobic potentials. It is proved by confident ( $p \leq 0.05$ ) increase of loads at level of anaerobic metabolism's threshold (AnMT) in athlete of the tested group. After course application of "Energel. Endurance" the athlete of main group demonstrated increase of power in average by 20.7 W that, in average, was by 12.1% higher than results of the first testing. At the same time, in control group power at AnMT level practically remained at initial level (increased, in average only by 2.8 W (1.5%)) (see fig. 2). It can be explained by ergogenic action of amber and apple acids, which are component of the gel. Biological significance of this effect lies in the fact that there happens quick re-synthesis of adenosine triphosphate by cells and

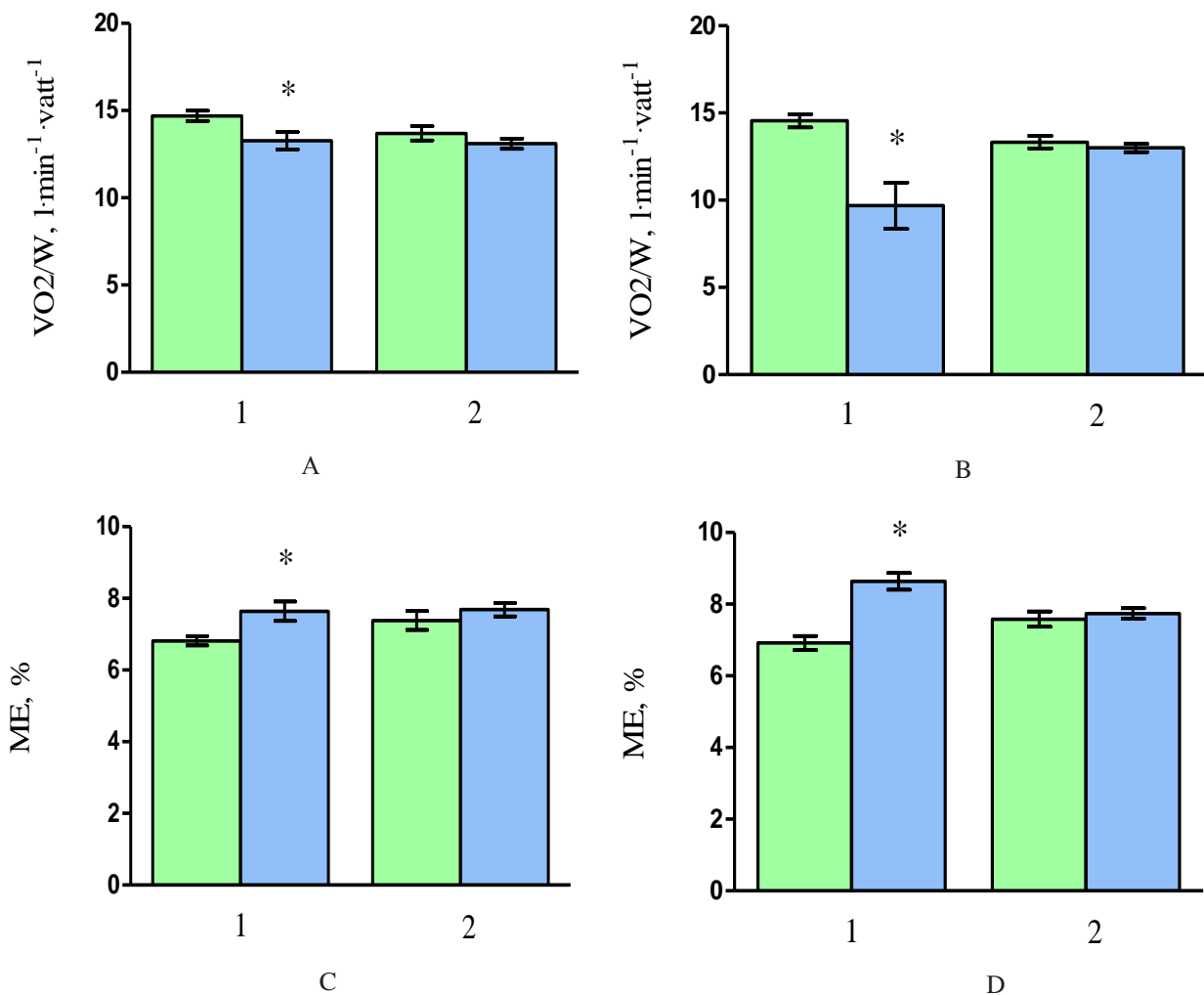


**Fig.1.** Diagram of athlete's testing procedure: 1 – warming up; 2 – standard work; 3 – recreation; 4 – stage-by stage increasing work; W – power; t – time, minutes.



**Fig. 2.** Mean power of test loads at AnMT level (A) and MOC (B) in experimental and control groups (n = 14): 1 – experimental group, 2 – control group. \* – p ≤ 0.05; W – power; t – time, minutes.

■ – beginning of the research,  
■ – end of the research.



**Fig. 3.** Influence of “Energel. Endurance” on economy and effectiveness of test loading fulfillment on ergo meter at AnMT (A, C) and (B, D) MOC levels: 1 – experimental group; Ec – economy, економічність, Ef – effectiveness; \* – p ≤ 0.05; W – power; t – time, minutes.

■ – beginning of the research,  
■ – end of the research.

increase of their anti-oxidant effect [1, 9].

Confident increase of work effectiveness on ergo meter was registered as product of power to oxygen consumption ( $\text{VO}_2$ ,  $\text{l}\cdot\text{min}^{-1}$ ); at AnMT and MOC levels. Results of experimental group athlete witness about increase of their aerobic potentials. Effectiveness of experimental group athlete's muscles work increased in average: at AnMT level by 11.7% (6.8 and 7.6% accordingly before and after course application of the substance); at MOC level – by 25.0% (6.9 and 8.7% accordingly). At the same time, in control group work effectiveness nearly did not change: at AnMT level it increased not confidently by 4.2% (7.4 and 7.7% accordingly before and after experiment); at MOC level – by 2.2% (7.4 and 7.7% accordingly before and after experiment, not confidently) (see fig. 3 C, 3 D).

Increase of aerobic energy supply component in experimental group athlete resulted in improvement of muscular functioning economy, which is found as product of oxygen consumption to achieved power of load ( $\text{VO}_2/\text{W}$ ,  $\text{l}\cdot\text{min}^{-1}\cdot\text{W}^{-1}$ ). After “Energel. Endurance” course application experimental group athlete achieved higher power of load at AnMT level (energy consumption). Results were found by oxygen consumption values ( $\text{VO}_2$ ,  $\text{l}\cdot\text{min}^{-1}$ ): 14.7 and 11.1  $\text{l}\cdot\text{min}^{-1}\cdot\text{W}^{-1}$  accordingly. Thus, economy of muscular work in experimental group increased by: 24.8% under loads at AnMT level; by 33.4% under maximal load. Such results witness about significant increment of aerobic energy supply component (see fig. 3A, 3B). In control group we did not register confident changes in economy of work. In control group we found the following: economy at AnMT level increased by 4.6% and by 2.6% under maximal load (see fig 3 F, 3 B).

## Discussion

On the base of the received new scientific data we expanded the arsenal of permitted ergogenic means, which are used in training of elite athlete: we worked out and recommended for practical application new functional product of carbohydrate character in conditions of intensive training and competition loads.

Increase of physical workability after course application of “Energel. Endurance” can be explained by the presence of metabolites of Krebs's cycle,  $\beta$ -alanine, mixture of carbohydrates and electrolytes in the content. With it, every element separately manifests its own properties.  $\beta$ -alanine increases carnosine in muscles, regulates inter-cellular calcium content and strength of muscular contraction; increases level of pantothenic acid [13, 25]. Carbohydrate mixture permits to preserve glycogen reserves and minerals keep electrolyte balance [2, 3]. It creates conditions for improvement energy supply of muscular functioning at the cost of aerobic component that permits to prolong working time without fatigue's increasing [5] (see fig. 4).

## Conclusions:

1. Positive influence of “Energel. Endurance” course application on athlete's physical workability and endurance (aerobic potentials) has been determined. It is proved by power of work confident increase by 12.1% at AnMT level.
2. “Energel. Endurance” course application by athlete facilitated increase of aerobic potentials. We found confident rising of effectiveness of load fulfillment at AnMT and MOC levels (in average by 11.7% and 25.0% accordingly). We also registered confident

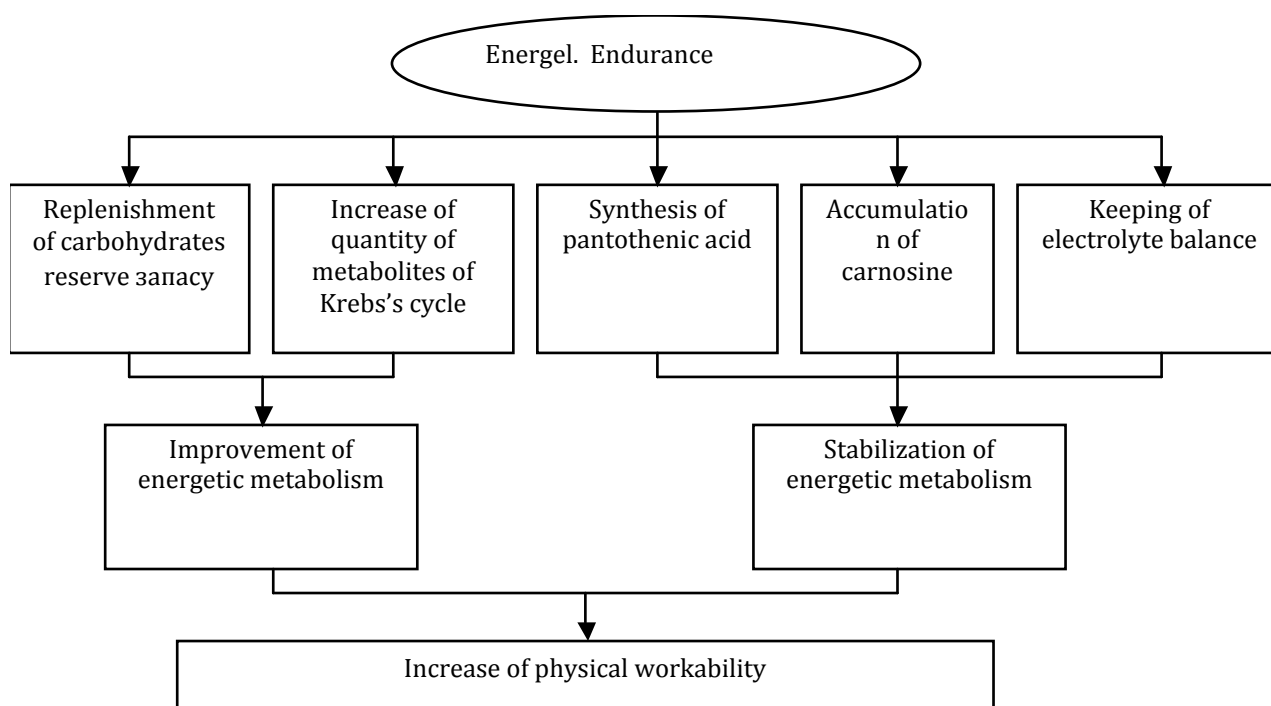


Fig. 4. Ways of realization of carbohydrate gel “Energel. Endurance” ergogenic influence under physical loads.

increase of muscular work economy: by 24.8% and by 33.4%, accordingly.

- The results of our research show that it is purposeful to use carbohydrate gel “Energel. Endurance”, under physical loads, requiring endurance.

### Acknowledgements

The research has been fulfilled in the frames of

scientific topic 2015-1 “Application of ergogenic factors in elite athlete’s training” (state registration number - 0115U000902).

### Conflict of interests

The authors declare that there is no conflict of interests.

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**Cite this article as:** Vdovenko N.V., Maidanuyk E.V., Ivanova A.M., Hrobatenko A.V. Influence of carbohydrate gel “Energel. Endurance” on athlete’s workability. *Pedagogics, psychology, medical-biological problems of physical training and sports*, 2017;2:94–99. doi:10.15561/18189172.2017.0208

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Received: 14.01.2017

Accepted: 31.01.2017; Published: 30.04.2017