

**DIRECTED INFLUENCE ON ANAEROBIC ENERGY SUPPLY SYSTEMS OF QUALIFIED FREE  
STYLE WRESTLERS**Sybil M.G., Pervachuk R.V.  
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**Abstract.** *Purpose:* to experimentally prove effectiveness of directed influence on anaerobic energy supply systems of free style wrestlers, considering individual characteristics of their bio energetic. *Material:* in this article the data of laboratory bicycle stress test «Vita maxima» and results of special control testing have been presented. 40 sportsmen participated in the experiment. *Results:* individual characteristics of dominating type of anaerobic energy supply have been determined. Statistically confident difference between development of lactate and a-lactate anaerobic energetic components were found. By the data of bio-chemical indicators' changes the authors observed increase of adenosine triphosphate (glycolytic or creatine-phosphate) in some, weaker developed mechanisms of anaerobic re-synthesis. Ways of influence on anaerobic energy supply systems, considering individual characteristics of dominating of different components (lactate or a-lactate) have been found. *Conclusions:* it is recommended to take in consideration individual dominating type of energy supply.

**Key words:** anaerobic, energy supply, wrestlers, lactate, a-lactate.

**Introduction**

Perfection of most important sport features of wrestlers (strength, quickness, flexibility and different kinds of endurance) is in fundamental dependence on bio-chemical, physiological and morphological characteristics of a sportsman as well as on their technical and tactic fitness [1, 4, 5, 15-17, 20]. It is well known that development of these qualities is in direct proportion with level of bio-energetic mechanisms of an individual: quickness of creatine-phosphate-kinase response, scope and intensity of glycolysis and concordance of biological oxidation (together with re-synthesis of adenosine triphosphate) [2, 6].

Leading role in free style wrestlers' physical condition is played by anaerobic potentials of organism against the background of well developed aerobic qualities [10, 13, 14, 18]. So we can conclude that for improvement of wrestlers' special sport workability it is necessary to perfect, first of all, those energy supply mechanisms, on which increment of sport results depend. At the same time, the problem of physical loads' regulation, depending on individual's functional fitness and specificities of his energy supply mechanisms, is still insufficiently experimentally substantiated.

In scientific sources there are elucidated questions about percentage correlation of aerobic and anaerobic components of energy supply [3, 8, 19]. However, in all analyzed by us literature, there were not found results of directed influence on certain components of anaerobic energy metabolism, the part of which is expressed weaker in manifestation of free style wrestlers' special workability.

**Purpose, tasks of the work, material and methods**

*The purpose* of our work was to experimentally prove effectiveness of directed influence on anaerobic energy supply systems of free style wrestlers, considering individual characteristics of their bio energetic.

*The tasks:*

1. Identify qualified free style wrestlers by individual characteristics of anaerobic energy supply within experimental groups.
2. Test effectiveness of authors' methodic on directed influence on development of a-lactate or lactate components during all experiment.
3. Prove effectiveness of experiment on individual influence on anaerobic energy supply components with the help of bicycle stress test «Vita maxima» and specialized control tests.

*The methods and organization of the researches:* the researches were conducted on the base of Lvov state university of physical culture. In experiment 40 free style wrestlers participated: 11 masters of sports, 14 – candidate masters of sports, 15 1<sup>st</sup> grade sportsmen. The sportsmen were divided into main group (MG) and comparative group (CG) by method of random sampling and they were homogenous. It is proved by the absence of statistically confident difference between mean values of background indicators of special control tests and results of bicycle stress test “Vita maxima” [11], which imitates special load of wrestlers by duration, intensity and scope of energy consumption. In the course of experiment we fulfilled pedagogic and bio-chemical monitoring over increment of special sportsmanship and energy supply systems' condition. Pedagogic tests contained key exercises, which determine successful action of free style wrestlers at competitions [7]. All anaerobic exercises were identified in the base of questioning of specialists and experts in this kind of sports, as a-lactate and lactate [9]. As bio-chemical markers of anaerobic metabolism we used creatinine (a-lactate criterion), lactic acid (lactate criterion), urea (as aerobic criteria), criterion of stress-response. Excretion of bio-chemical indicators was determined with the help of express-tests “Lachema” firm (Czech Republic) [12].

### Results of the research

According to increment of bio-chemical values in response to dozed loading participants of the experiment were sub-divided in separate cluster groups – “a-lactate”, “lactate” and “mixed”. Then, by belonging to these groups sportsmen of main group received task to train by the authors’ program, which considered individual dominating characteristics of bio-energetic in the course of realization of wrestlers’ special muscular efforts. In particular “a-lactate” wrestlers had expanded volume of “glycolytic” loads while “lactate” wrestlers – “creatine-phosphate”. Wrestlers, who belonged to “mixed” group, were trained alternatively under lactate or a-lactate loads during experiment. The members of comparative group trained by traditional methodic according to normative documentation [7].

Analysis of creatine indicators of main group’s sportsmen in conditions of control specialized tests’ influence and bicycle stress test Vita maxima before and after experiment points that in “a-lactate” cluster difference by this bio-chemical parameter is not statistically proved (see fig.1).

At the same time, these sportsmen manifest statistically confident difference between data of lactic acid before and after experiment. With it, increment is 6.7 %. It witnesses presence of expansion boundaries of endurance glycolytic component and is a result of directed influence on lactate type of energy supply, connected with wrestlers’ special muscular efforts (see fig.2).

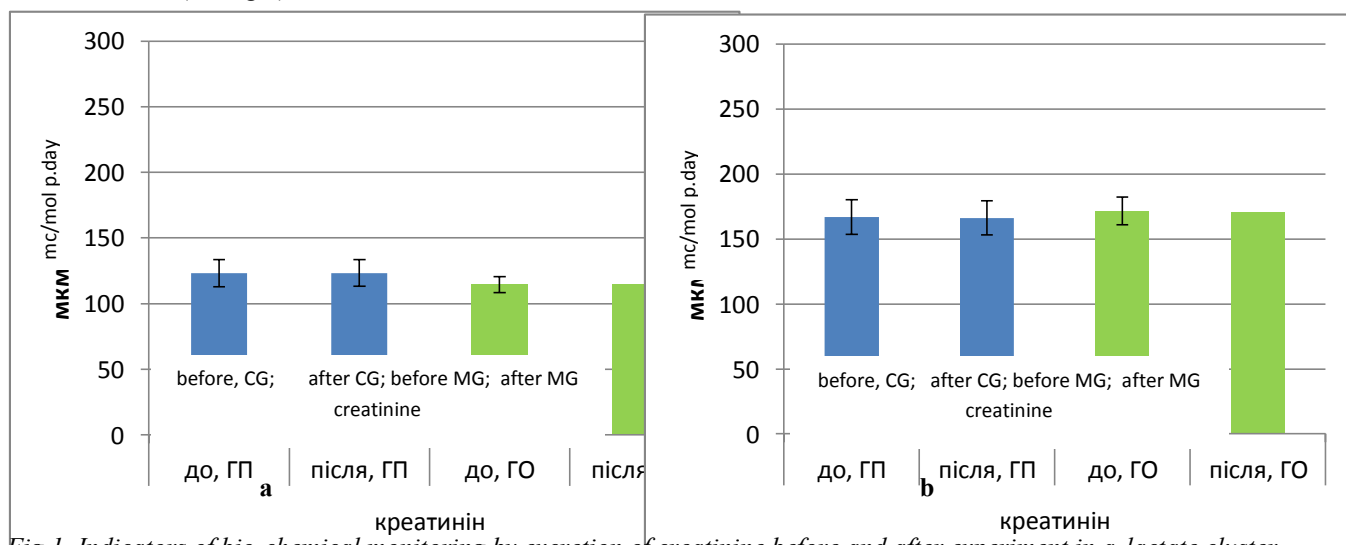


Fig.1. Indicators of bio-chemical monitoring by excretion of creatinine before and after experiment in a-lactate cluster (of main and comparative groups): a) by bicycle stress test «Vita maxima»; b) by results of control special tests. ( $p \geq 0.05$ ). CG – comparative group, MG – main group.

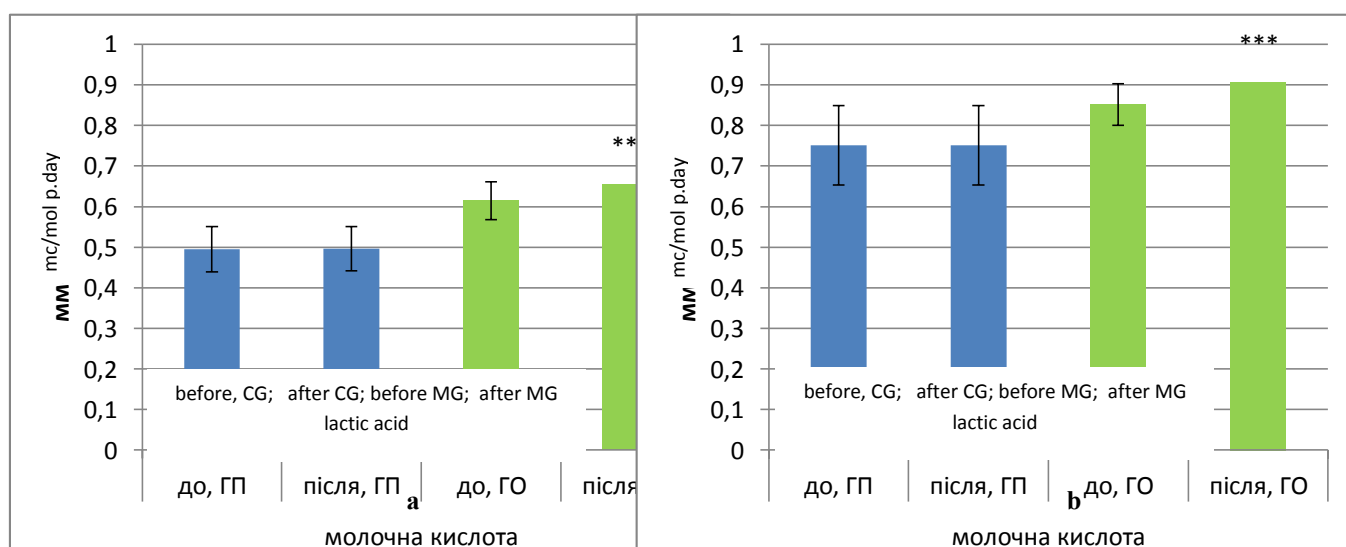


Fig.2. Indicators of bio-chemical monitoring by excretion of lactic acid before and after experiment in a-lactate cluster (of main and comparative groups): a) by bicycle stress test «Vita maxima»; b) by results of control special tests. (\*\*\*) -  $p \geq 0.001$ ). CG – comparative group, MG – main group.

Urea (as universal criterion of tiredness) is usually used in bio-chemical monitoring for control over tension of aerobic component of endurance and determination of stress-response. In fig.3 we show results of urea excretion before and after experiment. One can see that there is no statistically confident difference between them ( $p \geq 0.05$ ). Thus, we can

make conclusion: in main group directed influence on main a-lactate energy supply mechanisms has been achieved. It permits to avoid stress-response. It is shown by level of urea, which is within normal values.

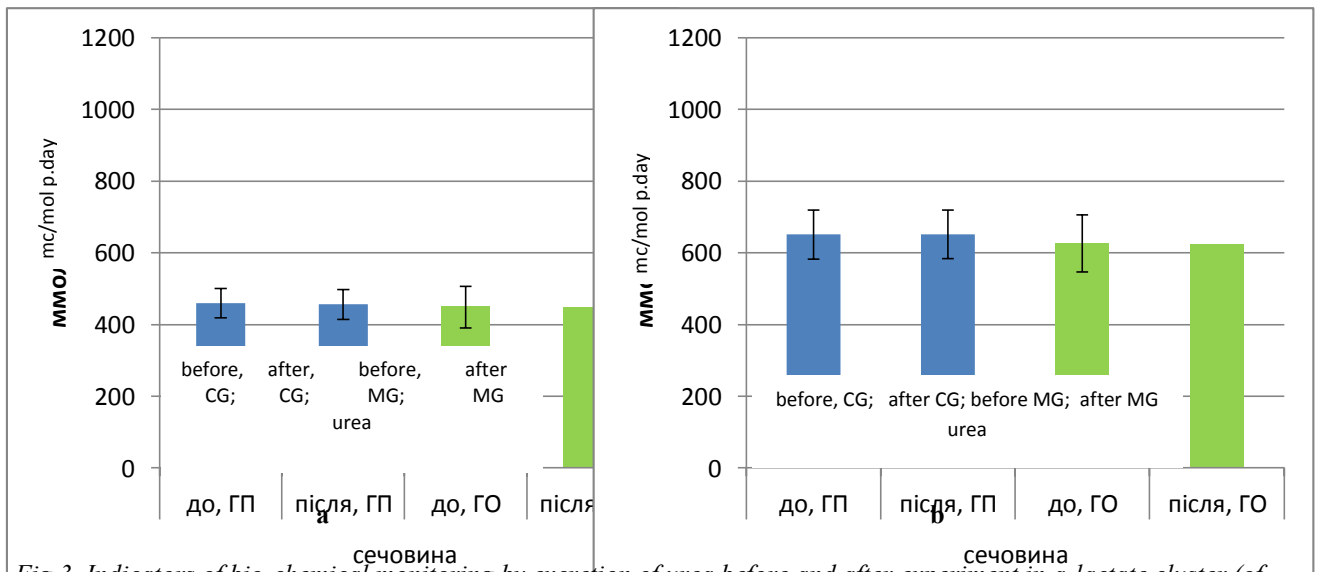


Fig.3. Indicators of bio-chemical monitoring by excretion of urea before and after experiment in a-lactate cluster (of main and comparative groups): a) by bicycle stress test «Vita maxima»; b) by results of control special tests. ( $p \geq 0.05$ ). CG – comparative group, MG – main group.

Such difference in urea excretion (at level of static error) was also in “lactate” cluster representatives (see fig. 4).

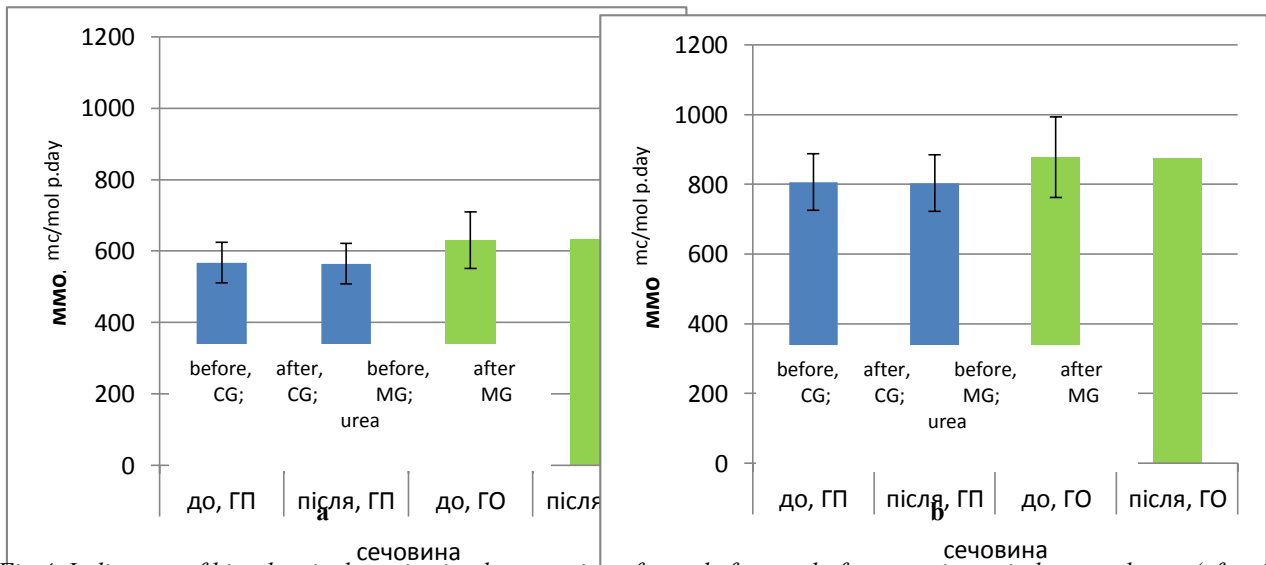


Fig.4. Indicators of bio-chemical monitoring by excretion of urea before and after experiment in lactate cluster (of main and comparative groups): a) by bicycle stress test «Vita maxima»; b) by results of control special tests. ( $p \geq 0.05$ ). CG – comparative group, MG – main group.

Comparative characteristic between indicators of lactic acid before and after experiment in “lactate” cluster is not statistically confident (both in response to test “Vita maxima”, and to special control tests) (see fig.5).

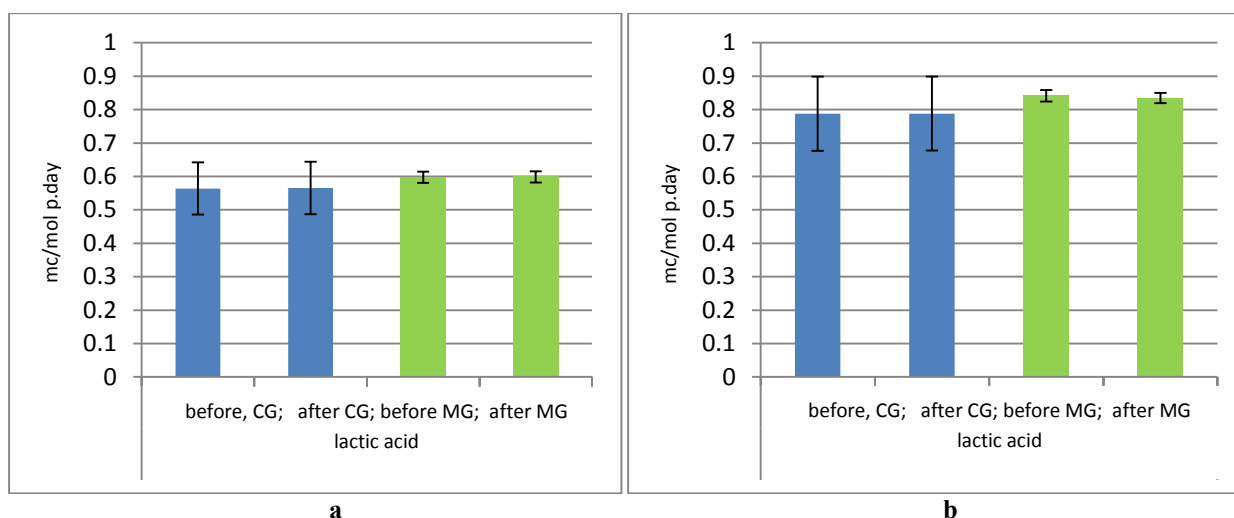


Fig.5. Indicators of bio-chemical monitoring by excretion of lactic acid before and after experiment in lactate cluster (of main and comparative groups): a) by bicycle stress test «Vita maxima»; b) by results of control special tests. ( $p \geq 0.05$ ). CG – comparative group, MG – main group.

With it we observed substantial expansion of borders of adaptation of creatine-phosphate-kinase energy supply mechanisms, which is expressed in increment of creatinine within 6-7 %. It is a result of directed influence on a-lactate component of endurance (see fig.6).

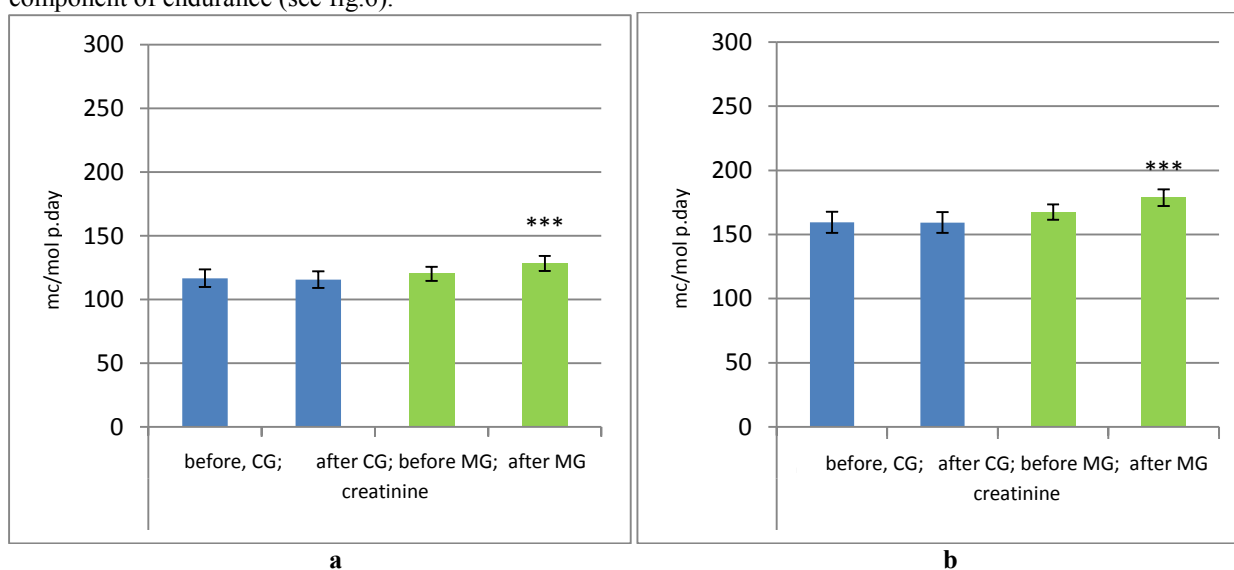


Fig.6 . Indicators of bio-chemical monitoring by excretion of creatinine before and after experiment in lactate cluster (of main and comparative groups): a) by bicycle stress test «Vita maxima»; b) by results of control special tests. (\*\*\*) - $p \geq 0.001$ ). CG – comparative group, MG – main group.

Analysis of creatinine and lactic acid excretion indicators (see figs. 7 and \*) in mixed main group points at moderate changes between data taken before and after experiment. They vary approximately equally and are 2-3 % (also they are statistically confident,  $p \leq 0.01$ ). That is why we can speak about certain positive trend of directed influence on both links of anaerobic metabolism.

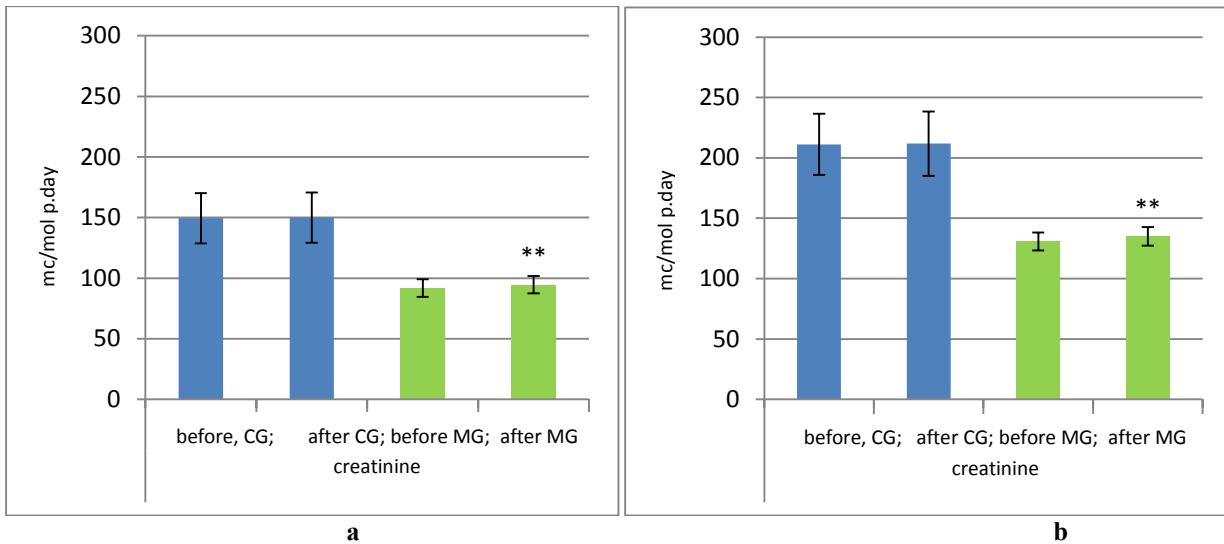


Fig.7. Indicators of bio-chemical monitoring by excretion of creatinine before and after experiment in mixed cluster (of main and comparative groups): a) by bicycle stress test «Vita maxima»; b) by results of control special tests. (\*\* - $p \leq 0.01$ ). CG – comparative group, MG – main group.

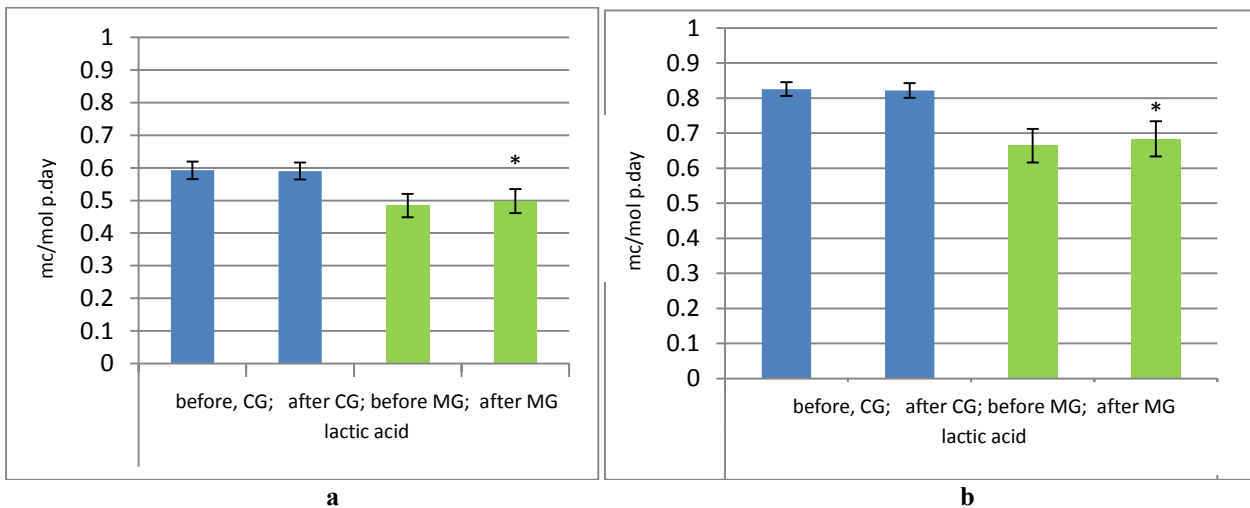


Fig.8. Indicators of bio-chemical monitoring by excretion of lactic acid before and after experiment in mixed cluster (of main and comparative groups): a) by bicycle stress test «Vita maxima»; b) by results of control special tests. (\* - $p \leq 0.05$ ). CG – comparative group, MG – main group.

Urea indicators are similar (see fig. 9).

Moderate character of bio-chemical parameters' changes as well as similarity of their quantitative characteristics is explained by the set task, according to which in the course of experiment this category of participants endured directed influence on both anaerobic energy supply mechanisms alternatively.

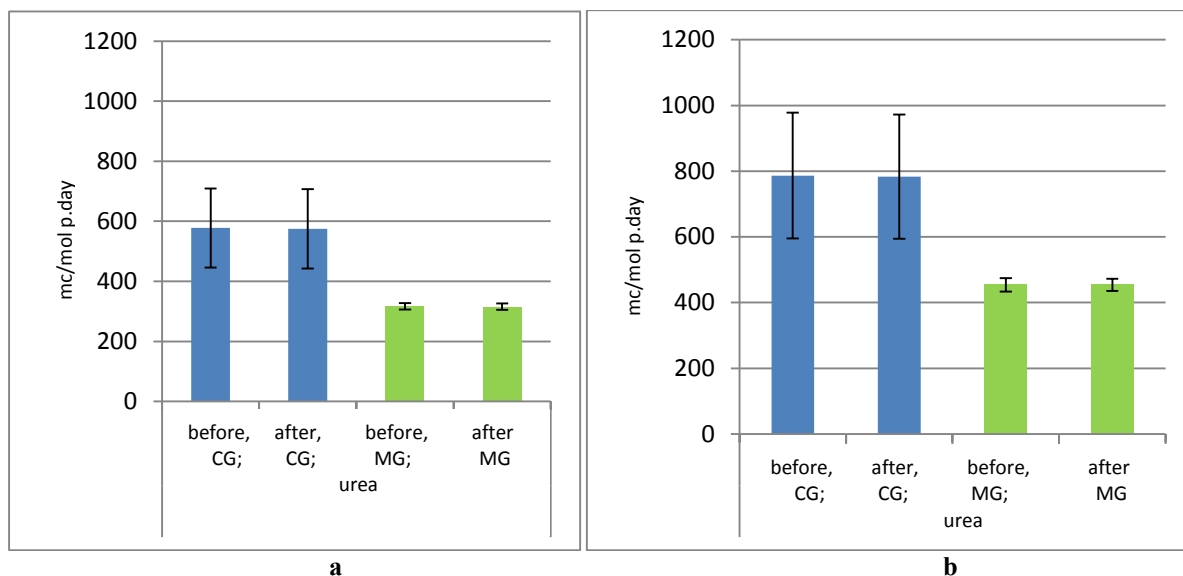
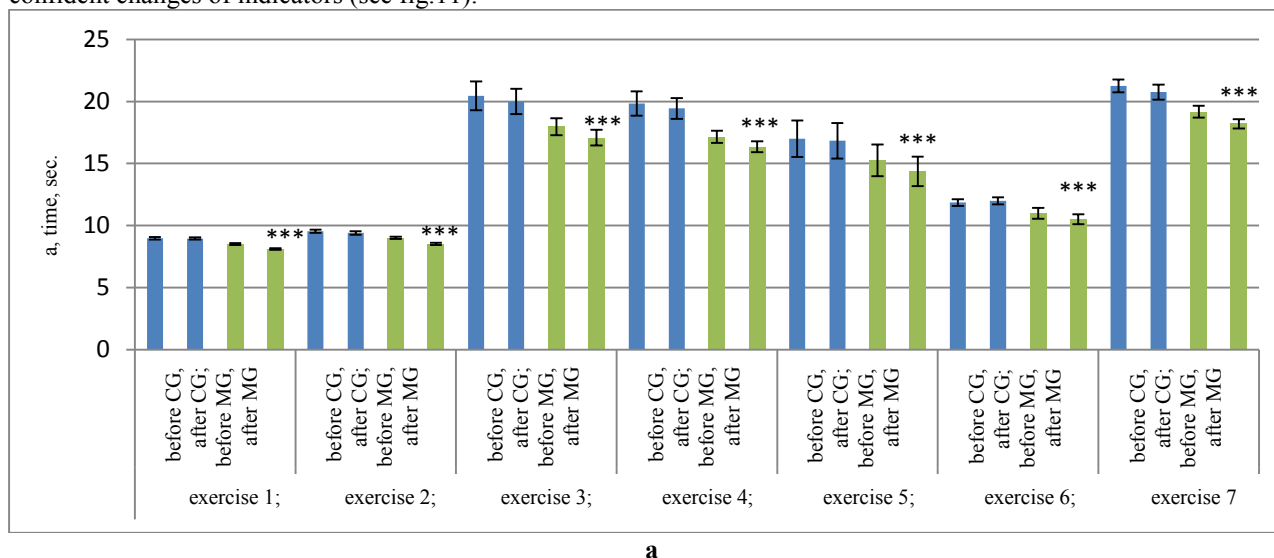


Fig.9. Indicators of bio-chemical monitoring by excretion of urea before and after experiment in mixed cluster (of main and comparative groups): a) by bicycle stress test «Vita maxima»; b) by results of control special tests. ( $p \geq 0.05$ ). CG – comparative group, MG – main group.

In comparative group we did not find statistically confident difference by all bio-chemical parameters under influence of such loads in the course of experiment.

Results of control testing, which was conducted before and after experiment, are given in the form of the following below diagrams. In fig.10 we present results of control testing in “lactate” cluster. As we can see improvement of indicators is noticed in exercises for a-lactate component of energy supply. They are exercises 1-7. At the same time, by results of exercises 8 and 9 (for lactate component of energy supply) we did not notice confident difference before and after experiment. In comparative group there was no confident improvement after control exercises.

In “a-lactate” cluster results of exercises 8 and 9 before and after experiment confidently differ that witnesses about activation of lactate energy supply, resulted from application of the authors’ training methodic. Fulfillment of “a-lactate” oriented exercises did not show confident improvement of results. In some cases in both groups there were confident changes of indicators (see fig.11).



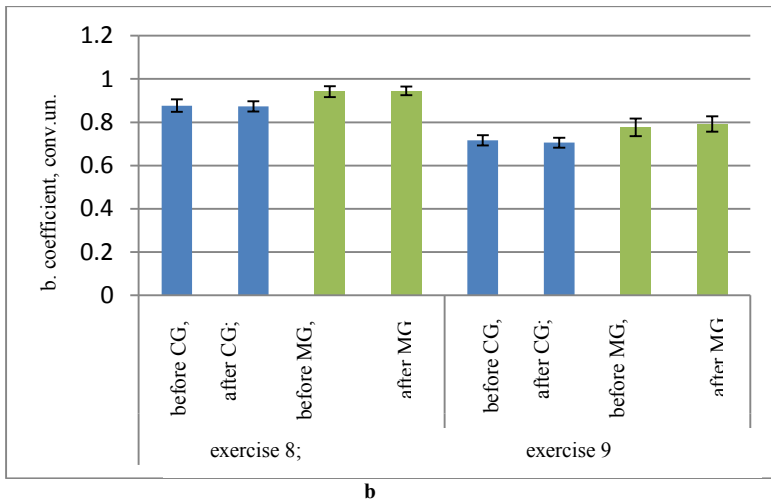


Fig.10. Indicators of control testing before and after experiment in main group (MG) and comparative group (CG), cluster “lactate”: a) a-lactate orientation; b) “lactate” orientation. ( $p \leq 0.001$ ). CG – comparative group; MG – main group.

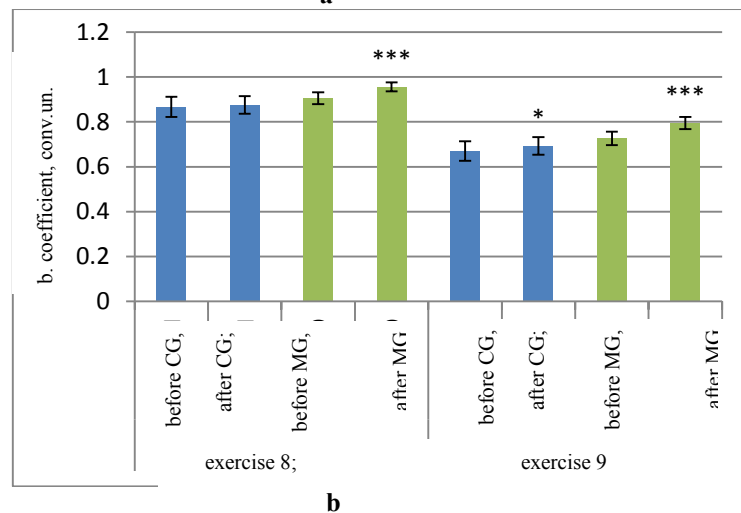
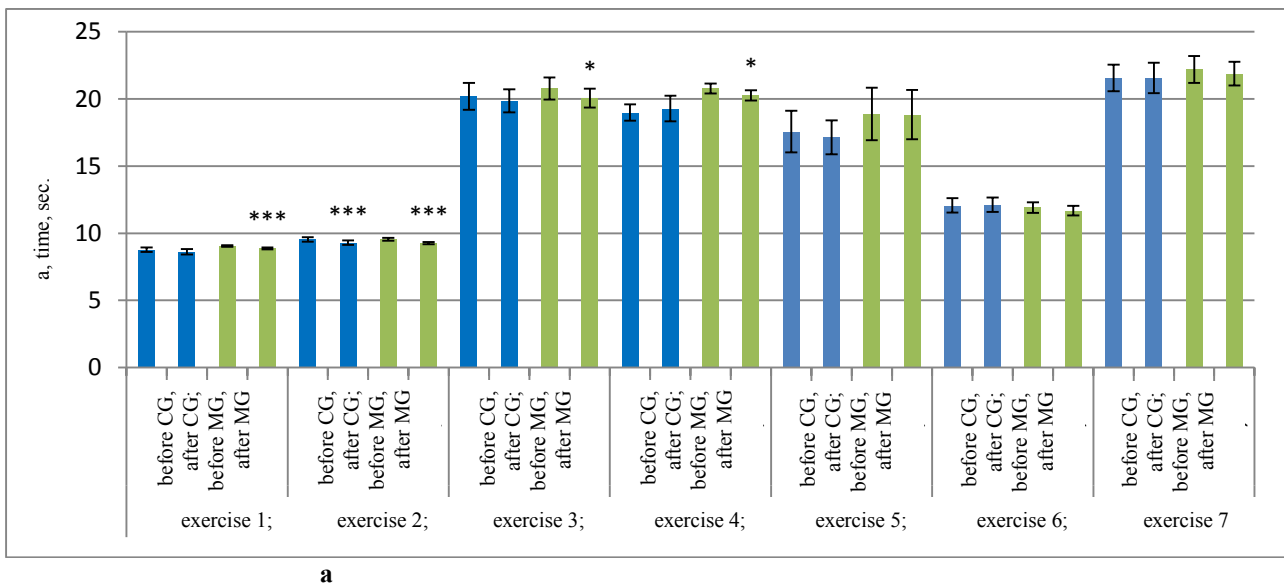


Fig.11. Indicators of control testing before and after experiment in main group (MG) and comparative group (CG), cluster “a-lactate”: a) a-lactate orientation; b) “lactate” orientation. ( $p \leq 0.001$ ). CG – comparative group; MG – main group.

Concerning mixed cluster, representatives of both CG and MG groups did not demonstrate statistically confident changes in control tests before and after experiment. However, in main group we observed some insignificant improvements within 2-3 %, that, in general, witnesses about effectiveness of the methodic and trend to improvement of sportsmen's special workability (see fig.12).

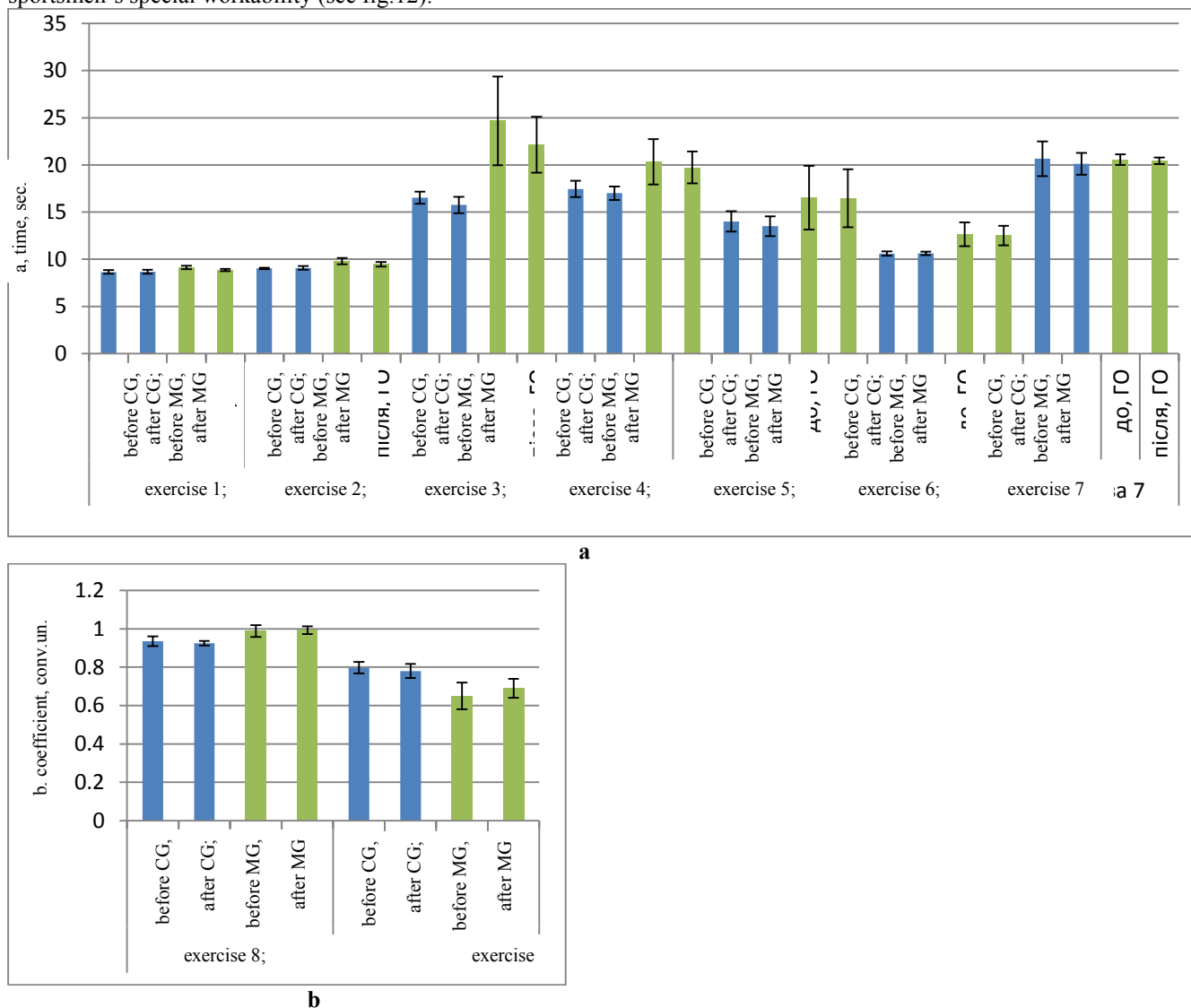


Fig.12. Indicators of control testing before and after experiment in main group (MG) and comparative group (CG), mixed cluster: a) a-lactate orientation; b) "lactate" orientation. ( $p \leq 0.001$ ). CG – comparative group; MG – main group.

## Discussion

The original postulate of our research was assumption that anaerobic energy supply mechanisms are the leading ones in sport progress of wrestlers. It agrees with data of A.D. Dadayan (1996), V. Sazonov, (2014), G.S. Tumanian (1986), Gierczuk D. (2012). Also views of advanced specialists on wrestlers' training, considering some components of this mechanism, are important: a-lactate and lactate (V.Ye. Kalnitskaya, 1989; N.I. Volkov, 2000; V.V. Shiyan, 1979). But the absence of experimentally proved information about application of individualization principle became a motive for our research. First of all we conducted personal identification of sportsmen in order to divide them into "lactate", "a-lactate" and "mixed" clusters. Besides, every representative of main group received personal tasks on expansion of scope and intensity of training of weak component in the course of experiment. As it is known, except genetically determined proportion between white (quickly contracted) and red (slowly contracted) muscular fibers there is a part of intermediate ones, which can be oriented on directed load. Thus, our hypothesis was experimentally substantiated. It resulted in increasing of effectiveness of that bio-energetic link, to which experimental factor was directed. In particular, a-lactate and lactate mechanisms expanded adaptation potentials. It reflected in strengthening of excretion. In the first case it was excretion of creatinine and in the second – lactic acid.



Besides, we registered improvement of experiment participants' responses to special testing and indicators of bicycle stress test. Main group sportsmen also improved efficiency of competition functioning and sportsmanship to better extent than comparative group sportsmen

### Conclusions:

1. We have determined individual characteristics of dominating type of anaerobic energy supply in group of 40 qualified free style wrestlers. Besides, we divided them into "lactate", "a-lactate" and "mixed" clusters.
2. The authors also have determined statistically confident difference in development of lactate anaerobic energetic component ("a-lactate" group – increase by 6-7% - by lactic acid excretion) and a-lactate anaerobic energetic component ("lactate" group – increase by 5-7% - by excretion of creatinine) resulted from usage of the authors' training methodic, which considered individual dominating energy supply type.
3. The authors also have determined statistically confident improvement of results of "a-lactate" oriented exercises in lactate cluster (by 5%), and "lactate" oriented exercises in a-lactate cluster (by 7.3%). In mixed cluster we observed trend to improvement of both types of exercises – "a-lactate" (up to 3%) and "lactate" (up to 3.2%) orientation.

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### Conflict of interests

Authors declare that there is no conflict of interests.

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