Directed increase of functional abilities among students-polyathletes during training for endurance race

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Abstract: The level of polyathletes’ mastery mainly depends on the degree of readiness for 100 meters race, shooting, swimming, grenade throwing and long-distance running. It was stated that in long-distance running polyathletes don’t have stable and progress results increase in comparison with other disciplines of all-round competitions. Stable results increase in long-distance running is determined by an effective aerobic processes development among athletes. The most important criterion of their estimation is anaerobic threshold index. That is why a high level of speed at the anaerobic threshold helps athletes to achieve better result during the main competitions of the season and it is reasonable to search for the new ways of the training cycle effectiveness improvement in a yearly cycle. Materials. We held the research in order to study the directed increase of functional abilities during training students-polyathletes for long-distance running in terms of non-profile higher educational establishment. Research methods. Information sources analysis and summarizing, diagnostics, testing, experiment, methods of mathematical statistics. Results. The research results showed that high sports results achievement during summer competitive period is connected with two trainings organization in each weekly microcycle. These two trainings present running at the level of anaerobic threshold. That is why polyathletes are able to keep higher speed during endurance running without organism acidulation and are able to show high sports results in the planned competitions. Conclusion. The received results can be used by the trainers during training students-polyathletes in one of all-round competitions disciplines – endurance running. Keywords: polyathlon, sports result, endurance, running at the level of anaerobic threshold, yearly cycle, students.

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provides sports results increase in long-distance running [10, 11].

However, the question of anaerobic threshold indices dynamics among students-polyathletes during training for long-distance running in yearly cycle is not studied enough.

The aim of the research is to study the directed functional abilities increase among students-polyathletes during training for endurance race in the preparatory period of yearly cycle.

**Materials and methods**

32 students-polyathletes at the age of 17-23 (men and women) with the following qualifications: from the 2nd sports category till master of sport, who go in for sports improvement section in RSAU – Moscow Agricultural Academy named after K. A. Timiryazev, took part in the research.

The research was held since 1 September, 2017 till the 1st of July, 2018 (yearly microcycle).

All athletes systematically trained in polyathlon during 3-6 years.

According to sports results, showed during the competitions before the beginning of the research, all athletes were divided into two groups. Individual athletes’ indices of physical development and physical readiness also didn’t differ validly (P≥0.05).

The first group included students-polyathletes. They were successful during the competitive period and had positive dynamics of the studied indices. The second group included students-polyathletes. They were not successful during the main competitions. They had negative dynamics of the studied indices or didn’t have sufficient physical readiness indices increase.

Sports training organization in a yearly cycle was oriented at the loads fulfillment. They are directed toward functional abilities increase and special endurance development, owing to 2 trainings held in each weekly microcycle connected with running at anaerobic threshold level speed. The anaerobic threshold was regularly defined during testing, approximately once in 5-7 weeks.

Anaerobic threshold was determined according to heart rate using F. Konkoni method with the help of sport-tester.

Polyathletes fulfilled a standard running test (4km) at the stadium or in an indoor track. Speed of running was gradually increased in 200-400 meters from 10 till 21 km/hour. The indices, received during AT speed determination at dependence diagram “Heart rate-speed of running” across linear fracture, are valid enough. That is why F.Konkoni test is used in many cyclic kinds of sport [10, 11, 12].

The number of training lessons according to the stages of polyathletes’ training in a yearly cycle in the experimental groups is presented in table 1.

According to all parameters the training process is organized taking into account the principles and recommendation. They are found in literature sources, published during recent years [3, 5].

Table 1 – The number of training lessons according to the stages of training students-polyathletes in a yearly cycle

| Stages of training     | Number of starts | Number of training lessons | General | Planned at the level of AT | Actual at the level of AT |
|------------------------|------------------|---------------------------|---------|---------------------------|---------------------------|
|                        |                  |                           |         | I group | II group |         |         |         |
| Involving              | -                | 39                        | 12      | 12      | 12       |
| I basic                | 2                | 70                        | 24      | 28      | 24       |
| Winter competitive     | 3                | 26                        | 18      | 15      | 10       |
| II basic               | 2                | 64                        | 26      | 38      | 28       |
| Precompetitive         | 1                | 31                        | 12      | 20      | 15       |
| Competitive period     | 5-6              | 30                        | 14      | 22      | 15       |
During the experiment sports results, demonstrated during summer competitive period (the second part of May-June) in 3000 meters running among men and 2000 meters running among women and training loads were analyzed. We determined the speed of running at anaerobic threshold level (V AT), heart rate at anaerobic threshold level (HR AT), maximum heart rate in the test (HR max).

Results and Discussions

The main criteria of research works’ effectiveness estimation were sports results, demonstrated during the competitions by students-polyathletes of each experimental group (table 2).

Table 2 – Dynamics of sports results in 3000 meters running among men and 2000 meters running among women during the research period

| Group | Initial results(X±δ) | Final results (X±δ) |
|-------|---------------------|---------------------|
|       | The average result, sec | The best individual result, sec | The average result, sec | The best individual result, sec |
|       |                      |                      |                      |                      |
| Men (n=14) |                      |                      |                      |                      |
| I      | 693,8±5,7           | 689,1               | 682,4,8±9,8         | 680,0               |
| II     | 694,3±8,0           | 691,5               | 693,8,4±3,4        | 686,8               |
| t      | 1,62                | -                   | 17,27               | -                   |
| P      | 0,05                | -                   | 0,01                | -                   |
| Women (n=16) |                      |                      |                      |                      |
| I      | 572,2±8,8           | 561,1               | 564,6±5,5         | 557,4               |
| II     | 570,8±6,2           | 563,8               | 570,1±5,5        | 563,4               |
| t      | 1,97                | -                   | 9,02                | -                   |
| P      | 0,05                | -                   | 0,01                | -                   |

Notes: According to validity criterion (t) and significance level (P), the validity of differences between the groups was determined.

Sports results analysis in 3000 meters running among men and 2000 meters running among women showed that sports results increased in both groups. However, the increase in the first group, both among men (11,4 sec) and among women (7,6 sec), was higher.

For the students’ functional state control during the whole period of the research we used F. Konkoni test: speed of running, corresponding to anaerobic threshold (AT), maximum heart rate, heart rate at AT level. The enumerated indices study was realized systematically at each stage of training. The dynamics of the studied indices increase is presented in table 3.

Table 3 – The dynamics of functional state indices and sports results increase during the research period

| Indices increase | VAT, m/sec | HR AT, beats/min | HR max, beats/min | 3000 meters running (men) and 2000 meters running (women), sec |
|------------------|------------|------------------|------------------|---------------------------------------------------------------|
| Men (n=14)       |            |                  |                  |                                                              |
| I group          |            |                  |                  |                                                              |
|                  | 0.36       | 2.2              | -1.7             | -11.4                                                         |
| t                | 3.46       | 5.05             | 3.05             | 16.0                                                          |
| P                | ≤0.05      | ≤0.01            | ≤0.05            | ≤0.001                                                        |
| II group         |            |                  |                  |                                                              |
|                  | 0.01       | -0.3             | -0.8             | -0.5                                                          |
Notes: according to validity criterion (t) and significance level (P) the validity of differences between the groups was determined.

Picture 1 presents the dynamics of threshold velocity.

**Table 1**

|       | I group | II group |
|-------|---------|----------|
| Women (n=16) |         |          |
|       |         |          |
| I     | 0,54    | 0,07     |
| t     | 6,31    | 2,42     |
| P     | ≤0,001  | ≥0,05    |
|       |         |          |
| II    | 4,0     | 0,6      |
| t     | 2,66    | 2,78     |
| P     | ≤0,05   | ≤0,05    |

Picture 1 – V_AT dynamics during the research period
During the research period VAT increased among men of the 1st experimental group for 0.36 m/sec, the 2nd group for 0.01 m/sec; among women of the 1st experimental group for 0.54 m/sec, the 2nd group for 0.07 m/sec. However, picture 1 shows that VAT curve, starting from the 1st basic stage, differs considerably in the 1st and the 2nd groups. In the 1st group it constantly increases (more smoothly among men than among women). In the 2nd group there is VAT decrease during winter competitive and the 2nd basic stage, then there is its insignificant increase during precompetitive period.

During the research HR indices at anaerobic threshold level were almost the same in both groups. Insignificant HR AT increase for 0.6-1.4 beats/min was invalid and was within the methodic error. HR AT increase among women from the 1st group for 4 beats/min was also invalid (P≥0.05).

Maximal HR in F. Konkoni test in both groups during the research period had the tendency of insignificant decrease. However, this decrease should be considered as the methodic error, as it is statistically invalid (P≥0.05).

Thus, running speed increase at anaerobic threshold level among students-polyathletes from the 1st group in a yearly cycle, is the main factor of sports achievements increase in endurance running. Students-polyathletes from the 2nd group had wavelike VAT curve with the peak during winter competitive stage. It wasn’t higher than this peak by summer competitive period. It can be connected with sports results stagnation in endurance race during this period.

**Conclusion**

1. As a result of functional abilities increase (running speed increase at anaerobic threshold level) sports results in 3000 m running among men improved for 11.4 sec and for 7.6 sec among women within one yearly cycle.

2. The offered variant of organizing two trainings of running at anaerobic threshold level in each weekly micro cycle provided constant sports results increase. During constant threshold speed of running correction in the 1st group increased within the preparatory period among men for 0.36 m/sec, among women for 0.54 m/sec. It provided higher results among polyathletes in endurance race.

**References**

1. Sadilkin A.F. Structure and content of yearly cycle of training polyathletes at the stage of sports improvement. Candidate’s thesis. Tambov. 2014; 187.

2. Gilmutdinov T.S. Training process organization among students- polyathletes during preparatory period. Poliatlon. 2000; 1-2: 18-20.

3. P.V. Komi, A. Ito, B. Sjodin, J. Karlsson. Lactate breaking point and biomechanics of running. Med. And Scien. In Sports and Exercise. 1981; 13(2): 114.

4. Ramsbottom R., Kinch R.F., Morris M.G., Dennis A.M. Practical application of fundamental concepts in exercise physiology. Advan. Physiol. Educ. 2007; 31(4): 347-351.

5. Germanov G.N., Nikitushkin V.G., Tsukanova E.G., Kulikov I.P. Expert estimation of exercises choice complex for local muscular endurance development among average distance runners. Kultura fizicheskaya i zdrove. 2012; 5(41): 23-27 [In Russ.].

6. Nikiforova O. N., Khoteeva M.V. The peculiarities of training process among students-athletes, who specialize in the average distance running. Razvitiie sovremennogo obrazovaniya: ot teorii k praktike; Materialy V Mezhdunarodnoj naucho-prakticheskoj konferencii [Modern education development: from theory to practice; Materials of the 5th International scientific-practical conference]. Cheboksary: LLC “Center of scientific collaboration” “Interactive plus”. 2018: 173-178.

7. Conconi F., Ferrare M. et al. Determination of the anaerobic threshold by a non-invasive field test in runners. Journal of Applied Physiology. 1982; 52(4): 869-873.

8. Suslov F.P., Nikiforova O.N., Sorokin E.P. Dynamics of anaerobic threshold indices of young runners of different age groups and qualification. Nauchno-sportivniy vestnik. 1990; 2: 20-23 [In Russ.].

9. Oleg V. Labeshchenkov. Auto-training influence on cadets’ functional state during airborne training. The Russian Journal of Physical Education and Sport. 2018; 13(4): 72-77. DOI
10. Danilo Fernandes da Silva, Samara Manzano Verri, Fabio Yuzo Nakamura, Fabiana Andrade Machado. Longitudinal changes in cardiac autonomic function and aerobic fitness indices in endurance runners: A case study with a high-level team. European Journal of Sport Science. 2014; 14(5): 443-451. DOI: 10.1080/17461391.2013.832802.

11. Bosquet L., Gamelin F.-X., Berthoin. Is aerobic endurance a determinant of cardiac autonomic regulation? European Journal of Applied Physiology. 2007; 100(3): 363-369. DOI: 10.1007/s00421-007-0438-3.

12. Bragada J.A., Santos P.J., Maia J.A., Colaco P.J., Lopes V.P., Barbosa T.M. Longitudinal study in 3000 m male runners: Relationship between performance and selected physiological parameters. Journal of Sports Science and Medicine. 2010; 9: 439-444.

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