UDK 378.091.313:796.015.5

ISSN (English ed. Online) 2311-6374
2018, №1(63), pp. 34-37

Perfection of the functional readiness of high-qualified athletes in the process of preparation for international competitions

Svetlana Karaulova
Nikolai Malikov

Zaporizhzhya National University, Zaporizhzhya, Ukraine

Purpose: *to evaluate the effectiveness of using the program of building the training process in the preparatory period of the annual macrocycle for improving the functional fitness of the athletes of the Ukrainian national track and field team in preparation for major international competitions.*

Material & Methods: *in the study participated highly qualified athletes aged 19–23 years, specializing in running for short distances (n=10) and have a sporting title MSU and MSIG.*

Results: *it is shown that the introduction in the preparatory period of this program, taking into account the dynamics of the components of the functional fitness of the athletes and the nature of their correlation with the model characteristics, contributed to a significant improvement in all indicators of the functional preparedness of the examined athletes. At the end of the preparatory period, the deviation of these indicators from the model values was only 2–6%.*

Conclusion: *the obtained results testified to the positive impact of the program on the overall level of fitness of high-qualified athletes in the process of preparation for major international competitions.*

Keywords: *functional preparedness, macrocycle, Olympic cycle, short-distance running, preparatory period, athletes.*

Introduction

The concept of further development of national sports and a clear strategy for the preparation for the Olympic Games are among the key areas in the system of Olympic training for Ukrainian high-class athletes. Leading experts indicate that the results of the Games Olympiad indicate a stable and fairly high position of Ukrainian athletes in the international arena. The emergence of new, even higher levels of sporting achievements makes higher demands on the overall preparedness of athletes and their individual components in the system of long-term sports improvement, especially at the stage of maximum realization of individual opportunities [4; 7].

In athletics, especially in cross-country sports, a high level of physical and functional preparedness plays a decisive role in achieving high sports results. According to the leading coaches of the national team of Ukraine in track and field athletics, special attention should be given to improving these components of the preparedness of high-qualified athletes in the process of preparing for major international competitions.

Analysis of the data of the scientific literature and practical coaching experience made it possible to determine that the questions of theoretical and methodical aspects of the construction of four-year cycles of training highly qualified athletes for the Olympic Games were studied [1; 7], problems and prospects for managing sports training for athletes of high qualification [5; 9], the organization of a strictly balanced system of training and competitive loads [8], the use of innovative technology to improve the training process [4; 10], recreation facilities, rehabilitation, promotion of efficiency and mobilization of functional reserves [3; 10].

Despite the certain efficiency of the presented approaches, a study and generalization of the experience of training highly qualified athletes for international start-ups – the Olympic Games, world championships, Europe, etc., may be a promising direction in this issue [2; 6].

One of the perspective approaches to improving the functional fitness of athletes is the orientation of the training process on the group and individual model characteristics of the competitive activity and preparedness of world-class athletes.

Relationship of research with scientific programs, plans, themes. The work was carried out within the framework of the state budget theme "Development of modern approaches to improving the system of restorative measures among athletes", State Registration No. 1/15, IP 0115U000819 for 2015–2016. And within the thematic plan of the Research Institute of Zaporozhye National University "Modern technologies for the training of athletes of various specialization and qualifications in Olympic sports", No. of state registration – 0116U004848.

Purpose of the study: evaluation of the effectiveness of using the program of building the training process in the preparatory period of the annual macrocycle for improving the functional fitness of the athletes of the Ukrainian national track and field team in preparation for the XXX Summer Olympic Games in London.

Material and Methods of the research

The study involved highly qualified athletes aged 19–23 years who specialized in running for short distances (n=10) and had the sporting title of MSU and MSIG. Five athletes were part of the national team of Ukraine in track and field athletics.

Organization of the study. Assessment of the effectiveness of the program for building a training process aimed at improv-

ing the functional fitness of athletes was conducted on the basis of testing results in the process of preparing the team for the Olympic Games 2012 in London.

The main features of the experimental program consisted in the redistribution of the volume of the training load of various orientations within the framework of the structural elements (micro, mesocycles) of the fourth macrocycle, namely the increase in the volume of the training load aimed at the development of power, speed, speed training, special speed endurance sprinters, and also increase the volume of exercises aimed at technical training (start, start-up acceleration), use of a significant running and jumping new exercises with weighting (weight 5–20 kg), the variability of training systems of different directions.

The testing was carried out at the beginning of the spring-summer (March) and at the end (June) of the preparatory period of the annual macrocycle preparation.

To assess the level of functional preparedness and its components in the study, a computer program for rapid assessment of the level of overall fitness for athletes was used. The algorithm of the survey within the framework of this program provided for the performance of the standard submaximal ergometric test PWC_{170}, as well as measurements of the length (cm) and the weight (kg) of the body of the athletes. The program carried out an automatic calculation of the value of total physical performance ($rPWC_{170}$), the value of aerobic capacity ($VO2_{max}$), the values of alactic and lactate capacity and capacity, anaerobic exchange threshold (AET), heart rate at the threshold of anaerobic metabolism (HR_{aet}), total metabolic capacity (TMC), reserve capacity (RC), economy of the energy supply system for muscular activity (ESS) and the general level of functional preparedness (LFP) of the athlete's body. All the quantitative values used in the program were calculated and distributed to functional levels: "low", "below average", "average", "above average", "high" [3].

In order to obtain the most objective information about the current level of general preparedness of the athletes participating in the study, model characteristics of the indicators of the functional readiness of the leading athletes of the world teams in track and field athletics (USA, Jamaica, Germany, France, Belarus, Great Britain) were won and prize-winners of the largest international competitions in the period from 2006 to 2011 (n=14). The statistical processing of the results of the study was carried out using standard STATISTICA 7.0 and EXEL packages with the following parameters: arithmetic mean (X), mean deviation (σ), arithmetic mean error (S).

Results of the research and their discussion

The results of the testing of female athletes of Ukraine, conducted at the beginning of the spring-summer preparatory period of the fourth macrocycle, indicated a somewhat lower level of functional preparedness of the female athletes and very significant deviations in the parameters of their functional readiness from the model characteristics (Table 1).

In Table 1 shows that the physical fitness and aerobic abilities of athletes were significantly lower compared to the model characteristics, respectively, by 14,35±1,20% and 8,39±1,60%, respectively. These indicators corresponded to

Table 1

Indicators of the functional preparedness of female athletes of the Ukrainian national team at the beginning and after the end of the study, $\bar{X}$±S

Indicators	Model characteristics	Ukrainian team (Start)	Ukrainian team (Completion)
$rPWC_{170}$, kgm·min^{-1}·kg^{-1}	25,18±0,30	21,57±0,20 (A)••• (14,35±1,20%)	23,90±0,23 (A/A)** (5,09±1,26%)
VO_{2max}, ml·min^{-1}·kg^{-1}	67,70±0,27	62,02±0,34 (H)••• (8,39±1,60%)	64,51±0,35 (H)*** (4,72±1,64%)
Alactic power, W·kg^{-1}	11,36±0,15	9,99±0,17 (H)••• (12,06±1,51%)	10,92±0,29 (H) (3,88±2,15%)
Alactic capacity, conventional units	65,47±0,47	60,91±0,25 (H)••• (6,97±1,13%)	62,92±0,76 (H)** (3,91±1,19%)
Lactate power, W·kg^{-1}	8,69±0,15	7,95±0,06 (H)••• (8,53±1,08%)	8,50±0,15 (H) (2,15±1,44%)
Lactate capacity, conventional units	55,26±0,54	50,27±0,27 (H)••• (9,03±1,12%)	52,52±0,45 (H)*** (4,96±1,30%)
AET, %	63,93±0,47	59,83±0,25 (A)••• (6,41±1,13%)	62,82±0,56 (A/A) (1,74±1,55%)
HRaet, beats·min^{-1}	173,94±0,83	164,45±0,81 (A)••• (5,46±1,40%)	168,60±1,07 (A/A)*** (3,07±1,63%)
TMC, conventional units	237,10±2,42	210,39±1,43 (A/A)••• (11,27±1,16%)	224,74±2,61 (H)** (5,21±1,47%)
RC, points	87,83±1,76	75,57±0,37 (A/A)••• (13,96±1,02%)	82,56±1,05 (H)** (5,99±1,17%)
ESS, points	84,35±0,80	74,08±0,25 (A/A)••• (12,18±1,05%)	80,64±1,27 (A/A)* (4,41±1,87%)
LFP, points	91,44±0,70	76,88±0,17 (A/A)••• (15,92±1,03%)	89,13±1,09 (H) (2,53±1,84%)

Remark. *H – high, A/A – above average, A – average functional levels; ••• – p<0.001 in comparison with the model indicators at the beginning of the study, * – p<0,05; ** – p<0,01; *** – p<0,001 in comparison with the model indicators at the end of the study, the tubs indicate% of the deviation from the model characteristics at the beginning and at the conclusion of the study.*

the "average" and "high" functional levels. Significantly lower values of alactic and lactate power (respectively, in comparison with model characteristics) were registered. 12,06±1,51% i 8,53±1,08%), values of alactic and lactate capacity (respectively on 6,97±1,13% and 9,03±1,12%). These components corresponded to a "high" functional class. The values of the deviation of the anaerobic exchange threshold and the heart rate at the AET level corresponded to the "average" level and had significantly lower deviations from the model values (respectively, by 6,41±1,13% and 5,46±1,40%). Higher values of deviations from the model values were registered among the indicators of the total metabolic capacity, the reserve capacity of the organism, the energy efficiency of the power supply system for muscle activity (by 11,27±1,16%, 13,96±1,02%, 12,18±1,05%), answered "above average" level.

Taking into account the presented data, the integral value of the level of functional readiness (by 15,92±1,03%), which corresponded to "above the average level", was significantly lower, as compared with the model characteristics.

The presented data testified to a "lag" behind the model values of the level of functional readiness and its structural components at the beginning of the study from 5% to 15%. Thus, such a dynamics of changes characterized the level of functional preparedness of Ukrainian team athletes as insufficient to achieve high results in the Olympic Games and provided an opportunity, on the basis of determining and reducing the threshold of deviation from the "model", further improving the overall level of training by introducing into the training process an experimental program for building a training process in the fourth macrocycle of the Olympic cycle of training.

The results of the final testing made it possible to ascertain the high efficiency of the proposed program for constructing the training process.

At the beginning of the summer competition period, athletes were noted, firstly, probably improving the physical performance (by 10,82±1,52% compared to the beginning of the preparatory period), aerobic performance (on 4,01±1,44%), values of alactic and lactate power (respectively on 9,30±1,95% and 6,97±2,73%), values of alactic and lactate capacity (respectively on 3,29±3,20% and 4,47±1,93%), anaerobic exchange threshold (by 4,99±2,46%), the heart rate at the level of AET (by 2,52±1,65%). Within 6-9% there was an increase in the values of the total metabolic capacity (by 6,82±2,08%), reserve capacity (by 9,25±3,01%), energy efficiency of muscular activity (на 8,85±5,17%).

Such a dynamics of positive changes in these indicators by the end of the study contributed to a significant increase in the overall level of functional fitness of the athletes 15,93±6,46%.

Secondly, it should be noted that, based on the results of the final testing, there were qualitative changes in indicators characterizing the level of functional fitness of athletes, most of the indicators corresponded to a high level of functioning, compared to the beginning of the preparatory period.

To confirm the positive effect of the program for building the training process that was implemented, a comparative analysis of the deviation from the model values of preparedness indicators for athletes was made at the beginning and at the end of the spring-summer preparatory period of the fourth macrocycle (Table 1).

It is shown that after the preparatory period, the lagging behind the model values of the physical fitness level and aerobic productivity was registered significantly lower, compared to the beginning of the preparatory period, and amounted to only 4–5% (Figure 1).

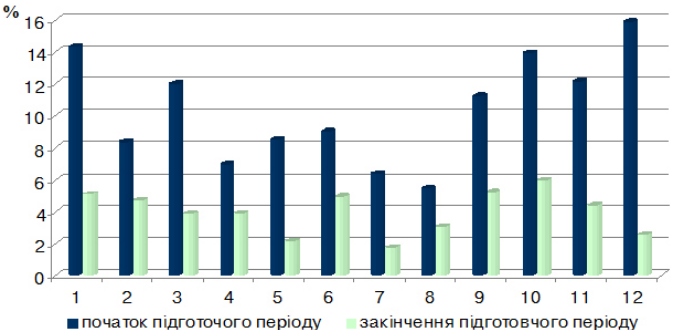

Figure 1. The values of the deviations of the indicators of the functional fitness of the athletes from their model characteristics at the beginning and at the end of the preparatory period of the fourth macrocycle (%):
1 – relative aerobic capacity ($rPWC_{170}$), 2 – maximum oxygen consumption, 3 – alactic power, 4 –alactate capacity, 5 – lactate capacity, 6 – lactate capacity, 7 – anaerobic exchange threshold, 8 – heart rate at the anaerobic exchange threshold, 9 – total metabolic capacity, 10 – reserve opportunities, 11 – economy of the energy supply system, 12 – level of functional readiness.

The values of the deviation for the indicators of alactic and lactate power were from 2% to 4%, for alactic and lactate containers – from 4% to 5%, the values of the threshold of anaerobic exchange and the frequency of heart rate at the level of AET – 2–3%, the values of total metabolic capacity – 5%, reserve capacity of the body – 6%, energy efficiency of the system of energy supply of muscle activity – 4%. The value of the deviation from the model value of the integral index of the general level of functional readiness was 2,5%.

On the whole, the results of a comparative analysis of deviation values made it possible to state that the athletes of the Ukrainian national team had a degree of deviation from the model values of the functional readiness indicators at the end of the spring-summer preparatory period and was only 2–6%. Thus, the received results testified to the positive impact of the program on the overall level of preparedness of high-qualified female athletes in the process of preparation for major international competitions.

Conclusions

Based on the results of the analysis of the problem of optimizing the general level of preparedness of high-qualified female athletes who specialize in running at 100 m and 200 m, the need for further improvement of the training process is shown in connection with the fact that now the level of development of world achievements in athletics raises the increased requirements for further approaches on the improvement of the national system of Olympic preparation, coincides with the data of the studies of other authors [2; 9; 16].

It should be noted that for the determination and evaluation of the overall level of preparedness for female athletes in our

study, the integral quantitative indicator of the level of functional preparedness was first used, which includes the components of the basic structural elements of the functional fitness of the organism of high-class athletes. This indicator is one of the main integral criteria for assessing and predicting the effectiveness of sports training.

The presented results testified to the expressed optimization of the level of functional readiness of the female athletes of the national team of Ukraine and confirmed the high efficiency of the program of building the training process in the system of preparation for major international competitions.

More convincing evidence of this was also the bronze awards of Ukrainian female athletes at the XXX Summer Olympic Games in London in the 4x100 m relay race and the establishment of a national record.

Prospects for further research in this area are to further study the dynamics of the level of functional preparedness of the female athletes, specializing in running for short distances.

Conflict of interests. The authors declare that no conflict of interest.
Financing sources. This article didn't get the financial support from the state, public or commercial organization.

References

1. Borzov, V.F. (2016), *Bolshoy sprint vo sne i nayavu* [Big sprint in a dream and in reality], Olimpiyskaya literatura, Kiev. (in Ukr.)
2. Dobrinska, N. V. (2015), *Udoskonalennya spetsialnoï pidgotovlenosti sportsmenok visokoy kvalifikatsiy v legkoatletichnomu bagatoborstvi: dis. kand. nauk po fizicheskomu vospitaniyu i sportu* [Perfection of special readiness of high-qualified athletes in track-and-field all-around: PhD diss.], Kyiv, 200 p. (in Ukr.)
3. Malikov, N.V., Bogdanovskaya, N.V. & Svatev, A.V. (2006), *Funktsionalnaya diagnostika v fizicheskom vospitanii i sporte* [Functional diagnostics in physical education and sport], Zaporozhe. (in Russ)
4. Mirzoev, O.M., Bodrova, N.D. & Bodrov, I.V. (2014), "Athletics. Current trends of running for 100 m", *Slobozans'kiy naucovo-sportivniy visnik*, No. 1(39), pp. 66-74, doi: 10.15391/snsv.2014-1.013. (in Russ)
5. Mikhalev, V.I., Aikin, V.A., Koryagina, Yu.V., Sukhachev, E.A. & Reutskaya, E.A. (2013), "Modern Trends in Training and Competitive Activity in Speed-Strengths of Track and Field Athletics (Based on Foreign Materials printing)", *Sovremennye problemy nauki i obrazovaniya*, No. 5, pp. 10-19. (in Russ)
6. Samolenko, T. (2007), *Osoblivosti bagatorichnoy pidgotovki visokokvalifikovanikh sportsmenok do Olimpiyskikh igor i Chempionativ svitu z bigu na seredni ta dovgi distantsiy (za danim avtoeksperimentu): avtoref. dis. kand. nauk po fizicheskomu vospitaniyu i sportu* [Features of long-term training of highly qualified athletes in the Olympic Games and World Championships in running for medium and long distances (according to the autoexperiment): PhD thesis abstract], Kharkiv, 20 p. (in Ukr.)
7. Shinkaruk, O.A., Dutchak, M.V. & Pavlenko, Yu.A. (2013), "Olympic preparation of sportsmen in Ukraine: problems and prospects", *Vestnik sportivnoy nauki*, No. 5, pp. 10-19. (in Russ)
8. Anisimova, E.A. (2013), "Methodical approaches to sports readiness improvement of qualified female sprinters", *Theory and practice of physical culture: a trainer : a journal in journal*, No. 3, pp. 66-68.
9. Čoh, M., Tomaћin, K. & Љtuhec, S. (2006), "The biomechanical model of the sprint start and block acceleration", *Physical Education and Sport*, No. 4, pp. 103-114.
10. Slawinski, J., Bonnefoy, A., Ontanon, G., Leveque, J.M., Miller, C., Riquet, A. Cheze, L. & Dumas, R. (2010), "Segment-interaction in sprint start: Analysis of 3D angular velocity and kinetic energy in elite sprinters", *J Biomech*, No. 43, pp. 1494-1502.

Received: 08.01.2018.
Published: 28.02.2018.

Information about the Authors

Svetlana Karaulova: *PhD (Physical Education and Sport), associate Professor; Zaporizhzhya National University: Zhukovsky str. 66, Zaporizhzhya, 69000, Ukraine.*
ORCID.ORG/0000-0003–1582-2368
E-mail: svkaraulova@ukr.net

Nikolai Malikov: *Doctor of Sciences (Biological), Professor; Zaporizhzhya National University: Zhukovsky str. 66, Zaporizhzhya, 69000, Ukraine.*
ORCID.ORG/0000-0001-8033-872X
E-mail: nvmalikov1957@gmail.com