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## CONSTRUCTION OF BASE MESOCYCLES OF RUNNERS AT MIDDLE- DISTANCE

Olga Roda<sup>1</sup>, Svitlana Kalytka<sup>1</sup>, Ninel Matskevych<sup>1</sup>

<sup>1</sup>Lesya Ukrainka Eastern European National University, Lutsk, Ukraine, sv-kalitka@ukr.net

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### Abstracts

**Topicality.** The issue of improving the training process of athletes is important at different stages of preparation. Therefore, the optimal construction of the training process of athletes, taking into account their functional state, becomes of increasing importance. **The Purpose of the Study.** To substantiate the structure and content of basic mesocycles of men who specialize in running at 800 m and 1500 m, based on their functional capabilities and special ability to work. **Methods of Research.** The following methods were used to achieve this goal: observation, pedagogical experiment, medical and biological methods (determination of heart rate (HR) and blood lactate) and methods of mathematical statistics. The survey was attended by 10 volunteer men who specialize in middle-distance running, at the age of 17-24, who qualified as candidates for the master of sports, I and II grades. **Results.** It is revealed that athletes who specialize in running at 800 m and 1500 m have the highest results of running the test with 4x400 m repeated loads in the third microcycle of the base mesocycle, accompanied by the optimal functional state of the cardiovascular system and energy supply of training work. In the fourth microcycle, the results of the test and the intensity of adaptive mechanisms of the body of the athletes were reduced to the exercise load, indicating an onset of fatigue. **Conclusions.** The results of the relationship between the level of manifestation of the functional capabilities of athletes and the performance of specific loads during the base mesocycle became the methodological basis for the development of their sports training programs. According to the positive adaptation to training loads in men, the construction of the mesocycle remains traditional: three shock microcycles and restorative. Implementation of the proposed programs of basic mesocycles in the training process of athletes significantly improved the functionality, special performance and results of the competition.

**Key words:** running at 800 and 1500 m, construction of the training process, adaptation, functional state, lactate, men.

**Ольга Рода, Світлана Калитка, Нінель Мацкевич. Побудова базових мезоциклів бігунів на середні дистанції. Актуальність теми дослідження.** Питання вдосконалення тренувального процесу спортсменів важливе на різних етапах підготовки. Тому дедалі більшого значення набуває оптимальна побудова тренувального процесу спортсменів з урахуванням їх функціонального стану. **Мета статті** – обґрунтувати структуру й зміст базових мезоциклів чоловіків, які спеціалізуються з бігу на 800 та 1500 м, на основі вивчення їхніх функціональних можливостей і спеціальної працездатності. **Методи.** Для досягнення поставленої мети застосовували такі методи, як спостереження, педагогічний експеримент, медико-біологічні методи (визначення частоти серцевих скорочень (ЧСС) і лактату крові) та методи математичної статистики. В обстеженні взяли участь 10 чоловіків-добровольців, які спеціалізуються в бігу на середні дистанції, віком 17–24 роки, які мали кваліфікацію I та II розрядів і кандидата в майстри спорту. **Результати.** Виявлено, що в спортсменів, які спеціалізуються з бігу на 800 та 1500 м, найвищі результати пробігання тесту з повторними навантаженнями 4x400 м у третьому мікроциклі базового мезоциклу, що супроводжується оптимальним функціональним станом серцево-судинної системи та енергозабезпеченням тренувальної роботи. У четвертому мікроциклі виявлено зниження результатів тесту й напруження адаптаційних механізмів організму спортсменів до виконаного тренувального навантаження, що свідчить про настання втоми. **Висновки.** Результати взаємозв'язку рівня прояву функціональних можливостей спортсменів та ефективності виконання специфічних навантажень протягом базового мезоциклу стали методологічною основою розробки програм їх спортивної підготовки.

Відповідно до позитивної адаптації до тренувальних навантажень у чоловіків побудова мезоциклу залишається традиційною: три ударні мікроцикли та відновлювальний. Упровадження запропонованих програм базових мезоциклів у тренувальний процес спортсменів значно покращило функціональні можливості, спеціальну працездатність і результати змагань.

**Ключові слова:** біг на 800 м та 1500 м, побудова тренувального процесу, адаптація, функціональний стан, лактат, чоловіки.

**Ольга Рода, Светлана Калитка, Нинель Мацкевич. Построение базовых мезоциклов бегунов на средние дистанции. Актуальность темы исследования.** Вопросы совершенствования тренировочного процесса спортсменов являются важными на различных этапах подготовки. Поэтому все большее значение приобретает оптимальное построение тренировочного процесса спортсменов с учетом их функционального состояния. **Цель статьи** – обосновать структуру и содержание базовых мезоциклов мужчин, специализирующихся в беге на 800 м и 1500 м, на основе изучения их функциональных возможностей и специальной работоспособности. **Методы.** Для решения поставленной цели применяли такие методы, как наблюдение, педагогический эксперимент, медико-биологические методы (определение частоты сердечных сокращений (ЧСС) и лактата крови) и методы математической статистики. В обследовании приняли участие 10 мужчин-добровольцев, специализирующихся в беге на средние дистанции в возрасте 17–24 года, которые имели квалификацию I и II разрядов и кандидата в мастера спорта. **Результаты.** Выявлено, что у спортсменов, специализирующихся в беге на 800 и 1500 м, высокие результаты пробегания теста с повторными нагрузками 4x400 м в третьем микроцикле базового мезоцикла, что сопровождается оптимальным функциональным состоянием сердечно-сосудистой системы и энергообеспечением тренировочной работы. В четвертом микроцикле выявлено снижение результатов теста и напряжения адаптационных механизмов организма спортсменов к выполненному тренировочной нагрузке, что свидетельствует о наступлении усталости. **Выводы.** Результаты взаимосвязи уровня проявления функциональных возможностей спортсменов и эффективности выполнения специфических нагрузок в течение базового мезоцикла стали методологической основой разработки программ их спортивной подготовки. Согласно положительной адаптации к тренировочным нагрузкам у мужчин построение мезоцикла остается традиционным: три ударных микроцикла и восстановительный. Внедрение предложенных программ базовых мезоциклов в тренировочный процесс спортсменов значительно улучшило функциональные возможности, специальную работоспособность и результаты соревнований.

**Ключевые слова:** бег на 800 и 1500 м, построение тренировочного процесса, адаптация, функциональное состояние, лактат, мужчины.

**Formulation of a research problem and its significance.** When we analyze the level of achievements of the athletes and trainers, specializing in running at middle distance, it becomes obvious that there is a need for a constant search for the latest forms of sports training [1; 3; 4; 8]. It becomes clear that it is impossible to infinitely increase the load, and therefore it is necessary to search for new methods for improving the sports training of stayers [2; 5; 6].

It is indicated in the scientific literature [2; 5] that the structure of the training process is based on the objective laws of the formation of sporting skills. This is due to factors that determine the effectiveness of competitive activities and the optimal structure of preparedness, peculiarities of adaptation reactions and individual characteristics of the athlete [5; 7; 8].

According to V.P. Platonov [5], the structure of the training process can be characterized by the nature of interconnection and correlation between different aspects of sports training (general and special physical training, technical and psychological training); correlation between parameters of training and competitive load (volume and intensity of load, rate of competitive activity in the total work load); the sequence and interconnection of different parts of the training process [6; 8].

**Analysis of the research into this problem.** Nowadays much attention is given to the proportion and effectiveness of the volume of general and special physical training, both at each stage and in the long-term plan for training conducting [1; 2; 5]. If the load performed by the athlete corresponds to his physical, psychological and morphological characteristics the effectiveness of the training will increase.

The investigation of the issues concerning the improvement of the training process in the system of long-term training in various sports and track-and-field disciplines has been carried out in a large number of studies [1; 2; 3; 4]. No papers, that highlight the questions of the functional state, the responses of adaptative mechanisms to specific loads, the preparedness and the construction of basic mesocycles for men who specialize in running on medium distances, were found. These issues form the topicality of our research.

**The goal and the specific tasks of the article.** The aim of the study is to substantiate the structure and content of basic mesocycles for men specializing in running at 800 m and 1500 m, on the ground of their functional capabilities and special productivity.

**Material and methods of research.** A set of methods was used to solve the tasks: analysis and generalization of scientific and methodical literature on the training of athletes; pedagogical observation; pedagogical experiment; medical and biological research methods; mathematical statistics methods.

Having taken into account the issues of scientific substantiation of the process of sports training planning of athletes specializing in running on medium distances we have conducted a study in the natural conditions of the planned training process during two mesocycles.

The experiment involved 10 male volunteers (2 - CMS, 2 - I grade, 6 - II grade), aged 17-24, specializing in running on medium distances. The state of health of all athletes was within the physiological norm.

The performance of athletes at specific loads with simultaneous registration of the autonomic body systems functions was studied in the pedagogical experiment (re-challenge test). A test involving 4x400m run with a gradual increase in speed for each segment and a 5 minutes rest interval, performed in each microcycle was carried out to assess the level of anaerobic and aerobic capabilities of athletes.

The function of the cardiovascular system was assessed by heart rate (beats per minute) both in an idle state, after the exercise and during the recovery period. Monitoring of the heart rate was performed with the help of the test machine Polar S610i (Finland).

Biochemical studies (determination of the lactate and hemoglobin content, standard methods for taking blood samples from the phalanx) were performed by a medical laboratory assistant of the highest qualification category. Lactate content was measured using the BM-Lactate No. 25 test strips with the help of a testing device «Accutrend Plus» (Switzerland) on the third minute after each segment.

The obtained results have been analyzed using commonly used methods of variation statistics with the calculation of average values of individual indicators and standard deviation. Student's t-distribution for bound samples was used for statistical verification of hypotheses about the validity of discrepancies; with a 5% significance level taken as a basis during the verification.

**Statement regarding the basic material of the research and the justification of the results obtained.** The special working capacity and adaptive reactions of the athletes' body in the base mesocycle of the planned training process, containing five shock microcycle with significant loads that are identical in structure for all athletes, were investigated to determine the optimal construction of training loads in the mesocycles of men and women specializing in running on medium distances,.

Training devices, which mainly develop speed (0.6 km), anaerobic and aerobic (1.2-1.6 km) capabilities were applied on the first, third and fifth days of the microcycle. Activities for developing endurance and aerobic capacity (6-10 km), speed (0.6 km) and strength were used during the second, fourth and sixth days. The seventh day was reserved for rest, recovery and assessment of the functional state and working capacity. Consequently, the athletes performed the training load in the anaerobic zones - 3.6 km, mixed aerobic and anaerobic ones - 3.6-4.8 km, aerobic ones - 18-30 km per microcycle, which remained unchanged in volume, due to the to the intensity corresponding to their functional capabilities. Such structure of the mesocycle was chosen to investigate the formation of the delayed training effect.

A test with repeated loads - 4x400 m after 5 minutes of rest, which is often used in the training process of medium-distance runners, was applied to determine the level of their special working capacity. It was required that athletes run each subsequent segment at a higher speed.

No apparent difference during the mesocycles of the CMS and 1st grade athletes covering the segments was found (Table 1). The best result of covering the fourth segment was shown in the third microcycle and almost equal ones - in the first, second, fourth and fifth microcycles. Somewhat lower results of covering the segments were fixed in the fourth microcycle.

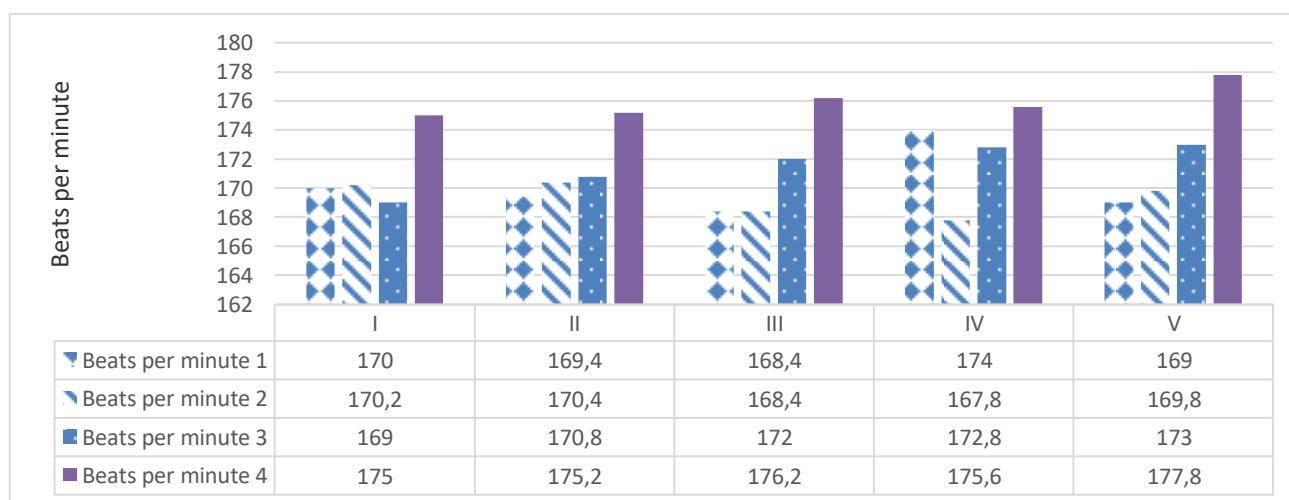
The results of covering the given distance by athletes of the 2nd grade improved from the first to the fourth segment in each microcycle. Hence, the best results were found in the first, third and fifth microcycles and somewhat lower results were fixed in the fourth microcycle and probably ( $p < 0,05$ ) lower - in the second microcycle, as compared to the third one.

**Dynamics of special working capacity of athletes, specializing in running on medium distances, during the mesocycle**

Segment (4x400m)	Microcycle	Result, s				
		I	II	III	IV	V
1	CMS, 1 <sup>st</sup> grade	66,28±5,53	67,62±5,83	67,54±5,46	67,84±6,30	67,52±7,36
2		64,20±4,23	64,10±4,51	64,54±3,88	64,96±4,44	65,82±4,57
3		63,20±1,69	63,92±3,75	65,40±5,94	64,18±3,11	63,81±3,21
4		60,56±2,71	60,42±2,77	59,82±3,41	60,68±2,96	60,46±2,89
1	2 <sup>nd</sup> grade	73,68±8,21	74,74±8,10*	72,98±8,01	73,80±8,25	73,60±7,65
2		71,76±4,53	72,64±4,17*	71,16±4,59	71,54±4,49	71,32±4,39
3		69,88±2,23	70,50±2,11	69,70±1,30	70,02±2,02	69,38±1,66
4		68,00±2,32	67,82±2,35	67,82±3,09	68,26±3,17	67,16±3,06

*Note.* \* – (p<0,05) – apparent result changes, as compared with the third microcycle.

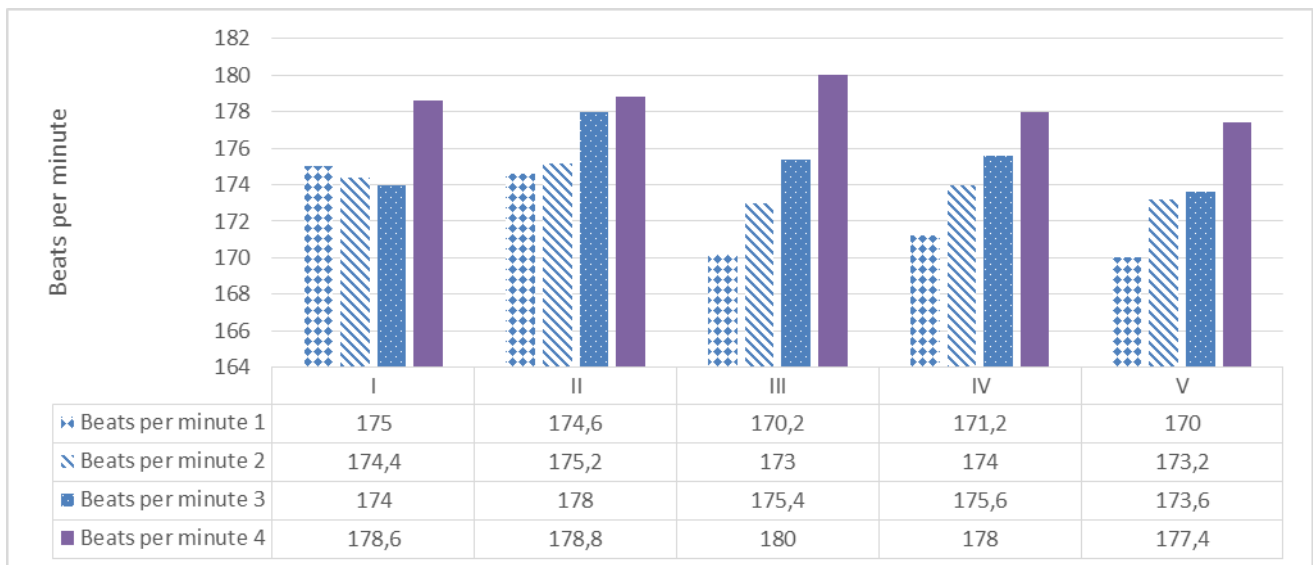
During the covering of segments, CMS athletes and 1st category athletes had the highest values of average heart rate in the third, fourth and fifth microcycles, somewhat lower - in the first and the second ones (Fig. 1).



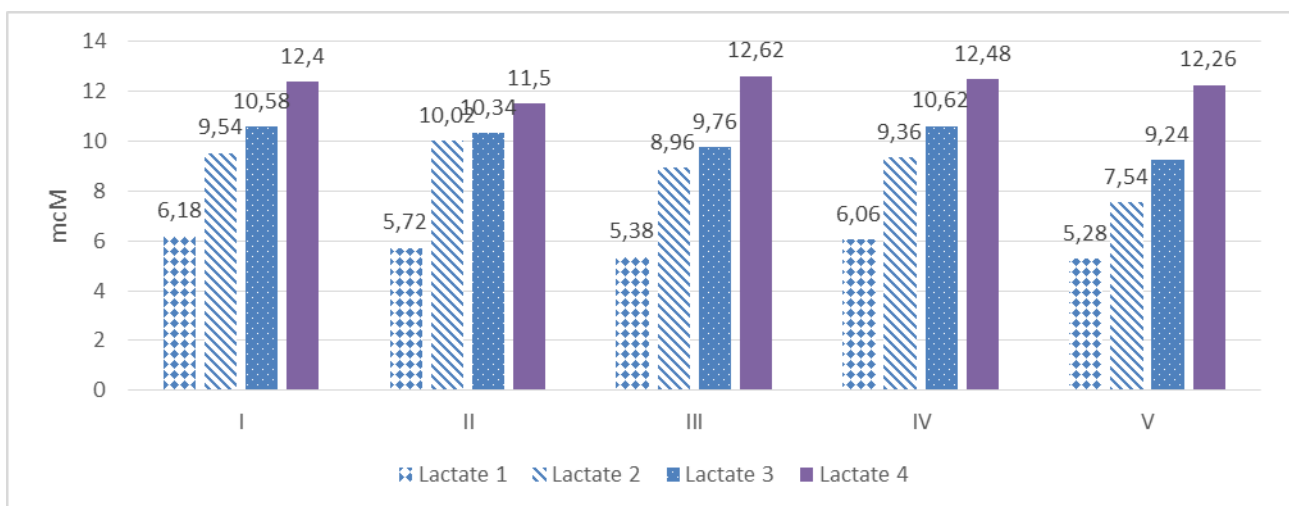
**Fig. 1.** Dynamics of average heart rate indicators in different microcycles of the training process of men, specializing in running on medium distances (CMS, 1st grade)

Athletes of the 2nd grade (fig. 2) had the highest values of the mean heart rate in the first and second microcycles, whereas it decreased significantly in the fourth and fifth microcycles. A decrease in heart rate in the third microcycle during the first three segments and an increase during the fourth segment were also indicated.

The concentration of lactate in the blood 3 minutes after covering each test segment was determined to evaluate the intensity of the load and the contribution of anaerobic energy supply to the completed work. Thus, the highest concentration of lactate in the blood of CMS athletes and 1st grade athletes covering the first segment was recorded in the first, third, fourth microcycle and slightly lower concentration - in the second and fifth microcycles (fig. 3).



**Fig. 2.** Dynamics of average heart rate indicators in different microcycles of the training process of men, specializing in running on medium distances (2nd rate)



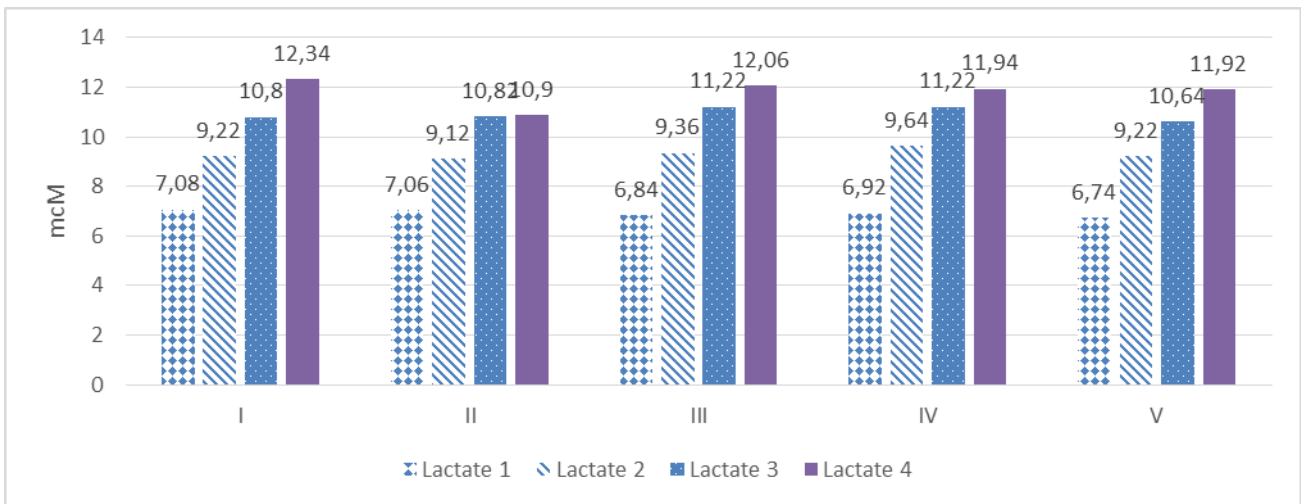
**Fig. 3.** Dynamics of lactate concentration in the blood of men, specializing in running on medium distances (CMS, 1st grade)

2nd grade athletes had the highest lactate concentration after covering the segments in the first and third microcycles and somewhat lower - in the second, fourth and fifth microcycles (Fig. 4).

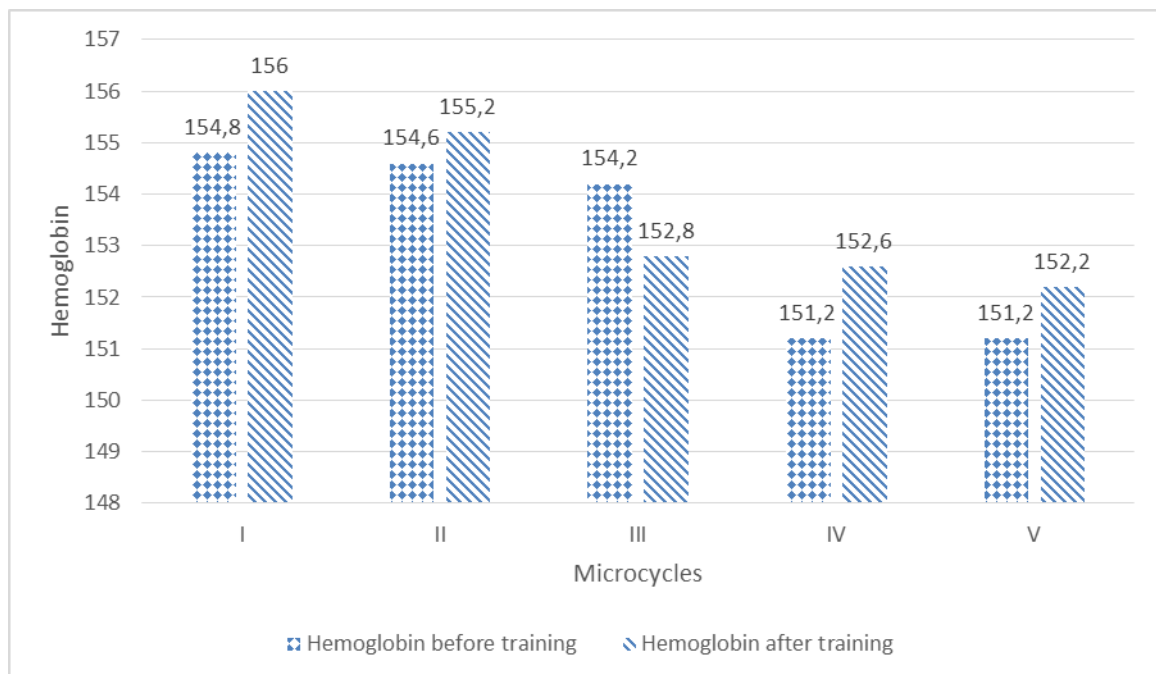
The hemoglobin content in the blood of CMS and 1st grade athletes prior to the training from the first to the third microcycles has remained at the level of  $154,80 \pm 11,99 \text{ g/l}$  ;  $154,60 \pm 9,40 \text{ g/l}$  ;  $154,20 \pm 6,42 \text{ g/l}$  respectively, the lower level was fixed in the fourth and fifth microcycles (fig. 5 ).It should be noted that the men's hemoglobin content did not significantly increase after training. The highest values were fixed in the first and the second microcycles. Somewhat lower levels were fixed in the third, fourth and fifth microcycles.

For athletes of the 2nd grade, the hemoglobin content in the blood prior to the training was high in the first, second and third microcycles and somewhat lower - in the fourth and fifth ones (fig. 6 ).

After performing the training load, hemoglobin gain was noted in all microcircles: in the first -  $157,00 \pm 17,03 \text{ g/l}$  , the second -  $158,40 \pm 16,32 \text{ g/l}$  , in the third -  $156,80 \pm 13,41 \text{ g/l}$  , the fourth -  $157,20 \pm 13,03 \text{ g/l}$  , the fifth -  $158,20 \pm 10,94 \text{ g/l}$ .



**Fig. 4.** Dynamics of lactate concentration in the blood of men, specializing in running on medium distances (CMS, 2st grade)

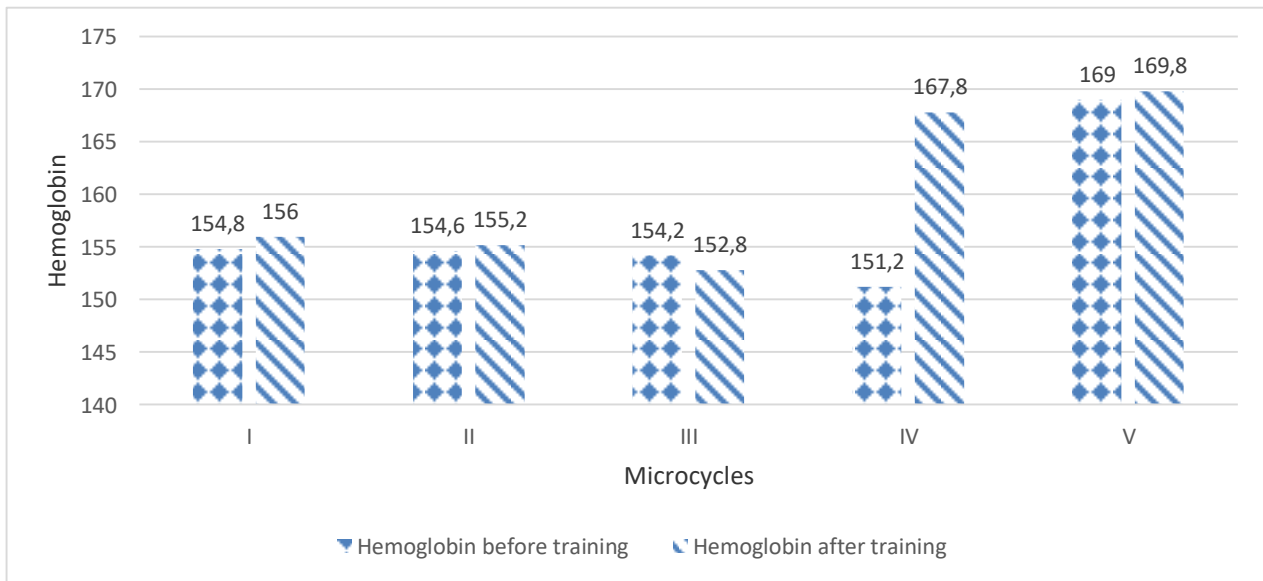


**Fig. 5.** Dynamics of hemoglobin content in the blood of men, specializing in running on medium distances (CMS, 1st grade)

The conducted study of the working capacity and functional state of athletes' body during the mesocycle was the methodological basis for the construction of basic mesocycles for men, specializing in running on medium distances. The amount of training load of different orientations during the shock and restorative microcycles of the training process of men has been determined (tab. 2).

Such training load, which increases in volume and intensity from one microcycle to another, contributes to the progressive increase of fatigue, the maximization of the capabilities of the functional systems mobilization of the body of the athlete. However, we have used restorative microcycles, which enabled us to restore the functionality and efficiency of the athletes, for the effective adaptation processes, fatigue prevention and overexhaustion during the training process (fig. 7).

Consequently, the results of the functional state change for athletes specializing in running on medium distances, during the mesocycle allow to plan the application of large and significant physical loads, improve the efficiency of the training process and functional capabilities.



**Fig. 6.** Dynamics of hemoglobin content in the blood of men, specializing in running on medium distances (CMS, 2nd grade).

**Discussion.** It was found that the working capacity and the functional state of men were increasing during the first three mesocycles and decreasing in the fourth and growing again in the fifth microcycle. The increase in the performance during the first three and fifth microcycles is due to the improved functional state of the cardiorespiratory system, anaerobic and aerobic potential growth, as evidenced by the indicators of lactate and hemoglobin. This is a consequence of the positive influence on the adaptive processes of training loads during these microcycles.

The decrease in the performance of all athletes during the fourth microcycle and of the 1st and 2nd grades athletes during the first three segments of the second microcycle may be due to the appearance of fatigue, failure to recover after high loads in previous microcycles, leading to a re-adaptation of the functional systems of the body. This is confirmed by the deterioration of the functional state of the cardiorespiratory system, the reduction of anaerobic and aerobic capabilities due to a decrease of the hemoglobin content in the blood, which reduces the oxygen delivery volume to the muscles, utilization of lactate and restoration of the heart rate. Hemoglobin content in the blood of CMS athletes was higher in the first, second and third microcycles and somewhat decreased in the fourth and fifth microcycles, which may be the result of not complete recovery after high loads in the first three microcycles.

The amount of training work reaches its maximum during the base mesocycles. An important feature of basic mesocycles is that weekly microcycles with a high load can last 3 weeks, and for athletes of high qualification - 4-5 weeks. The inclusion of a final restorative microcycle with a small total load, which contributes to the complete restoration and formation of the positive training effect and ensures the readiness of the body to implement the program of the next mesocycle is required for large total load of mesocycles of this type.

Table 2

**The structure and the content of the base mesocycle of athletes, specializing in middle-distances**

Microcycle type	The volume of training load (km)				
	Aerobic restorative zone	Aerobic developing zone	Aerobic-anaerobic zone	Anaerobic zone	Creatine-phosphate zone
1 <sup>st</sup> shock	11	24	-	1,4	2,8
2 <sup>nd</sup> shock	10	30	4	4	1,8
3 <sup>rd</sup> shock	11	36,5	5	4,5	1,8
4 <sup>th</sup> restorative	41	-	-	1,8	1,8
Total of 192,4 km	73	90,5	9	11,7	8,2

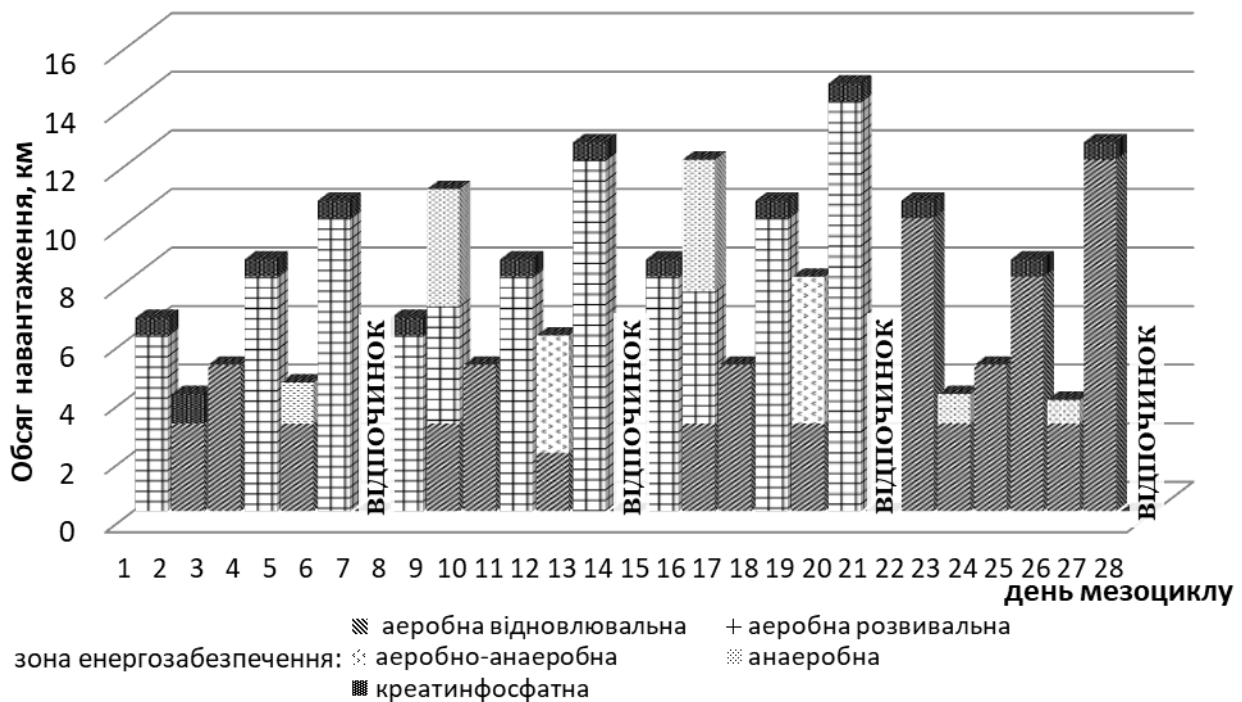


Fig. 7. Construction of the base mesocycle of the training process of athletes specializing in running on medium distances.

Consequently, changes in the functional capabilities and, hence, athletes' work capacity have become the methodological basis for building base mesocycles for athletes, specializing in running on medium distances. Our experiments confirm the data on the construction of base mesocycles for the training of athletes, gathered by V.M. Platonov [5]. The implementation of the proposed base mesocycles into the athletes training process has improved the outcome of the competitions.

**Conclusions and prospects for further research.** According to the analysis results it was determined that the construction of the training process of athletes, specializing in running on medium distances, is not properly reflected in the theory and method of sports training regarding their functional capabilities. A small number of works, mainly providing the analysis of physical, technical and tactical training, touches only upon teenagers' training.

It was determined that the CMS athletes and the 1st grade athletes showed the best result of 4x400m training in the third and fifth microcycles, and somewhat lower results during the first and second ones, and the lowest during the fourth one; athletes of the second grade had the best results in the third, first, second, fourth microcycles, and grew even more in the fifth microcycle.

Adaptive reactions to intense muscular activity of the body of athletes, specializing in running on medium distances, aimed at manifestation of the anaerobic endurance, are characterized by an optimal functional state in the first, second, third and fifth microcycles and by its minor decrease in the fourth microcycle, in particular: the functional value of the conducted work did not have significant changes during the mesocycle, meanwhile, the mean heart rate increases during the first three microcycles according to the results of 4x400m. training test runs. There was a slight decrease in the mean heart rate during the fourth microcycle, which was associated with a decrease in the speed of the training run, and a slight increase in mean heart rate of the CMS and 1st grade athletes in the fifth microcycle, and its decrease for athletes of the second grade at the highest rate of covering the segments; the content of hemoglobin, glucose and blood lactate did not significantly differ during the mesocycle, indicating that the energy supply of training work had remained at a relatively uniform level.

The results of the correlation between the level of functional capabilities manifestation of athletes and the handling of specific loads of the mesocycle have become the methodological basis for developing programs for training and competitive activities in microcycles and mesocycles of sports training. The



construction of the mesocycle for men remains the traditional - three shock microcycles and a restorative one, in accordance with the positive adaptation to the training load. The introduction of the proposed base mesocycles into the training process of male stayers has significantly improved the functional capabilities, the special working capacity and the competition results.

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