Organization of a macrocycle for the training of highly qualified female athletes specializing in modern pentathlon

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Abstract

Objective of the study was to develop and substantiate the structure of building a macrocycle for the training of highly qualified female athletes specializing in modern pentathlon.

Methods and structure of the study. The structure of building a macrocycle for the training of highly qualified athletes specializing in modern pentathlon has been developed, which includes a combination of basic training tools and the distribution of their volume, taking into account the specifics of the training of athletes in a given time period of the annual cycle. The scheme of the mesocycle of training of athletes, individualized in accordance with the biorhythmics of their body, is specified. The developed structure of training was tested in the training process of highly qualified athletes (n=6), masters of sports of international class, and its effectiveness was assessed by the magnitude of the increase in sports results and indicators in individual pentathlon disciplines compared to the previous year.

Results and conclusions. The structure of the macrocycle of training of highly qualified female athletes specializing in modern pentathlon has been developed, the effectiveness of which has been confirmed by the results of competitive activity. At the end of the first macrocycle, in comparison with the results of the previous year, in the combined relay race and the total amount of pentathlon points, statistical significance of differences was revealed ($p<0.05$). It is shown that when organizing the training process, one should take into account the individual characteristics of a particular athlete and rely on her leading motor abilities, which is most reasonable at the stage of the highest sports achievements.

Keywords: *highly qualified female athletes, modern pentathlon, annual training cycle, planning, means.*

Introduction. The modern pentathlon is one of the most difficult and at the same time spectacular types of all-around sports. Belarusian and Russian all-around athletes, as a rule, are among the strongest athletes in the world. At the same time, in recent years, representatives of the women's modern pentathlon of the two countries have achieved the best results. So, at the World Championships from 2017 to 2021, the winners and in the individual competition were the athletes of the national teams of Russia and Belarus - G. Gubaidullina, A. Prokopenko, O. Silkina.

It should be noted that the planning of the training process in the modern pentathlon has become more difficult due to the fact that the rules of the competition have been repeatedly changed recently. According to the new format (2022), modern pentathlon competitions are held almost without interruption, pentathlon types follow one after another, the largest tournaments include three stages of the competition. At the same time, it is necessary to take into account the duration of the competitive period and the high density of the competition. So, the first major competitions begin in January, then for seven months the stages and finals of the World Cup, the National Championship, the European Championship are held and the competitive period ends, as a rule, in September with the World Championship.

One of the aspects of improving the training of highly qualified all-around athletes is the search for the most rational options for constructing training cycles of various durations, and first of all, in the annual training cycle. In the training of qualified athletes, the

most widespread is the classical version of planning the training process based on one or two [2, 5] or several macrocycles [1]. Based on the current requirements for modern pentathlon, questioning of leading coaches [3, 4], analysis of special literature and practical experience, we developed the structure of a two-cycle periodization of the annual cycle of training highly qualified athletes.

Objective of the study was to develop and substantiate the structure of building a macrocycle for the training of highly qualified female athletes specializing in modern pentathlon.

Methods and structure of the study. The structure of building a macrocycle for the training of highly qualified athletes specializing in modern pentathlon has been developed, which includes a combination of basic training tools and the distribution of their volume, taking into account the specifics of the training of athletes in a given time period of the annual cycle. The scheme of the mesocycle of training of athletes, individualized in accordance with the biorhythmics of their body, is specified. The developed training structure was tested in the training process of six highly qualified athletes, masters of sports of international class, and its effectiveness was assessed by the magnitude of the increase in sports results and indicators in individual pentathlon disciplines compared to the previous year.

Results of the study and their discussion. In accordance with the developed training structure, the annual cycle includes two macrocycles, each of which consists of preparatory, competitive and transitional periods. In this article, we will consider the features of planning and content of sports training of highly qualified athletes using the example of the first macrocycle, the general preparatory stage of which includes three mesocycles: retracting (September), the first basic (October), the second basic (November, held in mid-mountain conditions). The main task during the general preparatory stage is to increase the level of general physical fitness of female athletes, increase the capabilities of the main functional systems of their body, develop the necessary sports, technical and psychological qualities. At this stage, when working with highly skilled pentathletes, it is recommended to perform significant amounts of training actions in swimming and running [1, 5].

The special preparatory stage of the first macrocycle includes 2 mesocycles: control and preparatory (December) and pre-competitive (January) training here should mainly be aimed at increasing special performance, which is achieved by the wide use of special exercises close to competitive ones and actually competitive ones. A significant place in the total volume of training work at the above stage should be given to highly specialized means that help improve the quality of individual components of special performance both in cyclic (swimming and running) and technical (fencing, shooting and riding) pentathlon disciplines.

The competitive period consists of one winter competitive mesocycle (February). Here, further improvement of various aspects of preparedness, stabilization of sports form, direct preparation for the main competitions and participation in them are carried out. The transitional period includes one recovery mesocycle aimed at restoring the physical and mental potential of an athlete after high training and competitive loads (Table 1).

Table 2 shows the average group load indicators in the cyclic disciplines of modern pentathlon in the preparatory (September-January) and competitive (February) periods of the first macrocycle. So, the total volume of running in the preparatory period was 952, and swimming - 162 km. In competition, respectively, 163.5 km, swimming - 28.3 km.

The following means of training were used: running at a speed below the AnTM level (anaerobic metabolic threshold), running at segments from 800 to 2000 m (with a speed at the AnTM level) and running from 200 to 1000 m (with competitive speed), swimming at segments from 25 to 1500 m (depending on the mesocycle), fencing, shooting, horseback riding. Also, specially designed complexes of jumping and athletics exercises were included in the training process.

It should be emphasized that when solving organizational issues of building the training process for women, one cannot ignore the results of numerous studies [4, 6], indicating that training mesocycles should be built in such a way that the content, means and methods of training influences in each lesson correspond to the level of physical performance, individ-

Table 1. *The structure of planning the training of highly skilled pentathletes in the annual training cycle (the first macrocycle)*

Periods	Preparatory					Competitive	Transition	
Stages	General preparatory			Special preparatory		Winter competitive		
Mesocycles	R	B	B	Cp	P	C	RM	
Months	IX	X	XI	XII	I	II	III	

Note: R- Retractor, B-Basic, Cp-Control and preparatory, P - Precompetitive, C - Competitive, RM - Recovery mesocycle

Table 2. *Average group indicators of training influences in cyclic disciplines of modern pentathlon (first macrocycle)*

Preparation tools	Preparation period				Competitive period	
	General preparatory stage		Special preparatory stage			
	Run	Swimming	Run	Swimming	Run	Swimming
Total volume, km	630	95	322	67	163,5	28,3
Aerobic and recovery orientation, km	480	70	185	22	70	8
% of total volume	***76,19***	***73,68***	***56,91***	***33,29***	***42,62***	***27,14***
Aerobic development orientation, km	117	18	93	26	62	15
% of total volume	***18,57***	***18,95***	***28,71***	***38,12***	***37,85***	***52,43***
Mixed, aerobic-anaerobic orientation, km	29	6	29	17	25	4
% of total volume	***4,6***	***6,32***	***8,94***	***24,80***	***15,7***	***15,5***
Glycolytic anaerobic orientation, km	4*	1*	13 2*	1 0,25*	5	1
% of total volume	***0,64***	***1,05***	***4,82***	***2,55***	***3,1***	***3,92***
Mixed, alactate-glycolytic orientation, km	-	-	2	0,75	1,5	0,3
% of total volume	***-***	***-***	***0,62***	***1,24***	***0,73***	***1,01***

*Note: * - volume of cyclic locomotions during testing procedures*

ual ability to recover, as well as the physical, functional and mental state of a particular athlete, which are specific to her in a certain phase of the menstrual cycle. Taking this into account, the schemes of the mesocycle of training of athletes were specified, individualized in accordance with the biorhythm of their body. At the same time, the "unloading" week of the mesocycle was planned for the premenstrual and menstrual phases, when physical performance is at a relatively low level (with a 28-day MC, this is the 26-28th day of one MC and 1-4 of the next). On all other days of the cycle, with the exception of the ovulation phase (days 13-15), where the load decreased again, the athletes were offered shock microcycles.

At the end of the macrocycle, a comparative analysis of the results of athletes was carried out (Table 3) (using the Wilcoxon criterion) shown at the largest competitions in 2022 and the current year (February 2023). Data analysis showed that in such pentathlon disciplines as swimming, riding and fencing, no statistical significance of differences was found. However, in fencing, the athletes practically reached statistical significance and increased the result by 16.71 points.

In the combined relay race and the final sum of the pentathlon, statistical significance of differences was revealed (for a 5% significance level). At the same time, in fencing, there is a decrease in the spread of points scored by female athletes in 2023, as evidenced by the coefficient of variation.

Conclusions. The effectiveness of the developed structure for building a macrocycle of training for highly skilled multiathlons is confirmed by the results of their competitive activities. So, at the end of the first macrocycle in 2023, in comparison with the results of the previous year in the combined relay race and the total amount of pentathlon points, statistical significance of differences was revealed ($p<0.05$).

It should be emphasized that any training system for a particular athlete should be consistent with her individual characteristics (including those related to MC) and timely adjusted depending on the state of the body at the time of the training session. Only with

Table 3. *Results of competitive activity (2022 and 2023) of highly qualified female athletes (n=6) in modern pentathlon disciplines*

Pentathlon disciplines	*2022* год Очки (X± σ)	V%	*2023* год Очки (X± σ)	V%	p-level	p
Fencing	212,29±27,62	14,05	229,0±17,32	8,17	0,15	>0,05
Swimming	265,0±6,35	2,59	263,29±7,34	3,01	0,73	>0,05
Horseback riding	285,71±16,48	6,23	286,43±10,34	3,9	0,99	>0,05
Combined relay	534,29±20,99	4,24	584,0±26,19	4,84	**0,034**	**<0,05**
Total score	1297,29±44,19	3,68	1368,0±35,45	2,80	**0,035**	**<0,05**

this approach, the content and direction of the training impacts will be determined by the real processes occurring in the athlete's body, and not by the figures of building various structural formations of the annual training cycle.

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