It has been found out that in the study group both before and after training a low speed of information processing and endurance rate was registered that testifies to inertia and fast fatigue of adaptation of teen volleyball players' central nervous system.

The investigation of the ratio changes in productivity and the accuracy of the mental work of teen volleyball players revealed a low level of the reliability indicator before training and an average level after training that indicates a positive effect of the performed muscular load on the dynamics of the psychophysiological characteristics of young volleyball players.

An analysis of the results of productivity studies, endurance, accuracy and reliability of work capacity allowed to assess indirectly the integral functional level of the nervous system of the adolescents surveyed that was defined as the average in operational rest and in the early period of restitution.

The study of the results of the test "Reactions to a moving object" demonstrates the predominance of responses to anticipation that proves the dominance of excitation processes in adolescents over inhibition showing a tendency to strike a balance after training.

The examined volleyball teenagers had high quantitative indicators of mental performance that declined after training and were combined with a low and medium level of its quality. This criteria as well as reliability improved after moderate physical work. The established features of urgent adaptation of the responsible departments of the nervous system of young volleyball players should be taken into account when completing teams and managing sports activities that can be a guide for training athletes on a leading principle and it will help teen volleyball players to create the prerequisites for increasing the endurance, productivity, accuracy and reliability of the central nervous system.

Prospects for further research are to study the age and gender features of adaptation of the central nervous system depending on the specific physical loads and in conjunction with the activities of other executive and regulatory systems.

Key words: *central nervous system, volleyball players, adolescents, functional state, mental performance.*

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INFLUENCE OF THE ORGANISM BIORHYTMICS OF THE QUALIFIED WOMEN-RUNNERS FOR SHORT DISTANCES ON THEIR MOVEMENT ABILITIES DYNAMICS

The article presents peculiarities of dynamics of subjective assessments of functional state and manifestation of motor capacities during ovarian menstrual cycle of athletes-runners for short distances. It is shown that level of manifestation of motor capacities of athletes varies in accordance with the phases of the cycle for specific biological cycle, each

characterized by a particular condition of a menstrual function and organism as a whole. With such state taken into consideration, an effectiveness of the training process can be raised without increasing the volume and intensiveness of applied loads.

The significant differences in the dynamics of the manifestation of individual motor abilities in athletes during the OMC have been found out, in particular: in the average level of manifestation and range of variation of indicators for the full cycle; in the ratio between the level of manifestation of physical qualities in the favorable and "critical" periods of the cycle; in the degree of influence of menstrual function on the change in the results of individual test exercises during the OMC.

It should be added that the high values of the variability of all the studied indicators in the menstrual, ovulatory and premenstrual phases of the OMC allowed us to assume that the level of manifestation of motor abilities in the "critical" phases of the cycle has significant individual characteristics.

From all of the above mentioned it can be concluded that during the OMC the level of manifestation of motor abilities of athletes varies depending on the phases of the cycle. In our opinion, taking into account this situation in the organization of the mesocycle of a particular athlete, it is possible to increase the productivity of his/her preparation, without unnecessarily increasing the volume and intensity of training influences.

***Key words**: athletes, ovarian menstrual cycle phase, motor capacities, individual characteristics.*

Introduction. Training athletes is a complex and multifaceted process of effective use of a number of components that ensure the optimal level of its readiness for its main start. At the same time, the most important aspect ensuring the highest sport result is the search for rational forms of building training loads in the annual cycle and in its individual structural formations [4; 6; 8; 9; 13]. At the same time, the individual approach is the potential factor of productive planning of the training process, which, first of all, should provide for biorhythmic features of the athlete's body, characterized by a variety of morphological, physiological and psychological changes.

Data on the training methodology for women reflect two dominant approaches to the issue under discussion [2; 9; 11; 17]. According to some scientists and practitioners, in the organization of training effects must be necessarily taken into account the cyclical function of the hypothalamic-pituitary-ovarian-adrenal system, that is, the ovarian-menstrual cycle (OMC). Others are convinced that planning of the training process should be regardless of the gender of the athlete, on the basis of the general patterns of sports training.

At the same time, there is no doubt that individual changes in athletic performance, motor qualities, functional and mental state of the woman's organism, throughout the childbearing period, largely depend on the biorhythmic features of her reproductive system [3; 7; 14]. The latter testifies that knowledge and use in the training activity of information about the laws of the functioning of the organism of a particular athlete is important not only for improving sports performance, but also for preserving her reproductive health.

A number of researchers note that excessive training effects are fraught with overtraining in women to a much greater extent than in men [5; 14]. This fact objectifies the need to prevent overtraining by normalizing the loads that are adequate to the operational state of the female body.

Thus, the priority for the development of individually targeted training programs, the choice of means and methods for the development of the necessary dominant motor abilities, both in multi-year planning and in the construction of various structural units of the annual cycle of a specific athlete, is the orientation toward the dynamics of its operability, functional capabilities of the basic systems of the organism and the course of regenerative functions in different phases of the OMC. In addition, monitoring of the individual dynamics of the athlete's biorhythmics will help optimize her direct preparation for the main competitions of the season [12; 15].

The purpose of the study was to determine the peculiarities of the dynamics of subjective evaluation of the functional state (SEFS) and manifestation of motor abilities during the OMC in female athletes specializing in running for short distances.

Methods and organization of the study. In the experiment, 16 athletes-runners for short distances with qualification of the first rank – CMS took part. Throughout complete individual biorhythmic cycle, each subject measured basal temperature (in order to determine the individual boundaries of the phases of the OMC) and tested by the SUN method. The use of the latter allowed, based on the results obtained for each scale of sums, revealing a subjective assessment of the functional state of the athletes in each of the phases of the MC.

In order to determine the level of manifestation of motor abilities 3–4 times a week before the main training session, testing was carried out, which included a certain set of control exercises. Thus, for the instrumental control of the power and speed-strength capabilities of various muscle groups of athletes, the method of computer strain gage was used, which consists in recording and analyzing the curve of development of muscle strength in time [2; 12; 15]. This instrumental technique allows assessing the level of special strength training of athletes, based on a set of specific data characterizing the individual's ability to manifest "explosive" efforts that are not available to direct measurement using traditional means.

Tensodinamograms of the manifestation of the strength of muscle groups bearing the main load in the structure of sprinting – muscles, leg extensors (LE) in the knee and hip joints and plantar flexors of the foot (PFF) were recorded and processed. In the isometric mode, the installation was shown to show the maximum arbitrary force, in the explosive isometric mode – to quickly achieve maximum force in the shortest period of time. The maximal isometric muscle strength (F_{max}) determined in the motion described and the time during which the maximum force (t_{max}) was reached were determined from the tensodynamometric curves obtained.

A differential power gradient (J) was also calculated, characterizing the rate of increase of the force to a maximum and numerically equal $J = \frac{F_{\max}}{t_{\max}}$. Since the repulsion phase in the race lasts 0,10–1,13 s [1, 16], the force developed by the athletes in 0,1 s ($F_{0.1}$) was determined.

Speed-strength abilities (in a dynamic mode) were evaluated based on the results of the jump up Abalakov (before and after training) with and without the help of hands. In order to assess the speed, the latent time of a simple motor reaction was determined, and the coordination abilities – as the difference in the jump up Abalakov with and without the help of hands.

The results of the study and their discussion. Parameters of the dynamics of the subjective evaluation of the functional state (SEFS) of athletes during the OMC indicate that its values in postmenstrual (II) and postovulatory (IV) phases are significantly higher ($p \leq 0,05$) than in menstrual (I), ovulatory (III) and premenstrual (V) phases, as well as above the average for the entire period of the specific biological cycle. It should be noted that there were no significant differences between the SEFS level in the II and IV phases and between the values of the "critical" phases (I, III and V) ($p \geq 0,5$).

As a result of the variance analysis, the degree of influence of the OMC as a factor on the change in the SEFS was determined, which was 22,4 % and is significantly higher ($p \leq 0,05$).

In the course of research, an unidirectional wave-like character of the dynamics of manifestation of physical qualities from phase to phase of OMC in athletics was revealed. It was foundout that a higher level of the studied parameters fell on the II and IV phases, and their decrease in the I (minimum), III and V phases. Such dynamics of manifestation of motor qualities (strength, speed, speed-strength and coordination capabilities) was found in numerous studies of other authors conducted in various sports [10; 12; 14].

In the present study, the peculiarities of the dynamics of individual physical qualities were revealed during the OMC, which were determined by differences in the average level of manifestation of motor abilities per full cycle, with respect to the maximum in phase IV (100 %); in the range of variation of the indicator for the full cycle; in the ratio of the level of manifestation of abilities between the favorable and "critical" phases; as well as the degree of influence of the OMC on the dynamics of each indicator in the specific phases of the cycle (Table 1).

Coordination abilities during the OMC varied within the limits of 17,6 %. The average level of manifestation of these abilities for the full cycle is 86,8±9 %. The values shown in phase II were significantly lower than in IV ($p \leq 0,05$), and during and before menstruation it was lower than during ovulation. The degree of influence of the OMC on the dynamics of the manifestation of coordination abilities was 8,5 % and was not reliable (see

Table 1), which may be due to high intra-individual and inter-individual variability of this indicator in individual phases of the OMC.

Table 1

The degree of influence of OMC (%) on the dynamics of manifestation of various motor abilities (results of dispersion analysis)

Motor abilities	Degree of influence	Validity of influence
Speed of motor reaction	16,8	p≤ 0,01
Coordination abilities	8,5	p≥ 0,05
Maximum arbitrary force - muscle LE - muscle PFF	 28,9 12,9	 p≤ 0,01 p≤ 0,05
Explosive force (isometric mode) - muscle LE - muscle PFF	 17,9 22,7	 p≤ 0,01 p≤ 0,01
Explosive strength of the muscles of the lower extremities (dynamic mode)	23,6	p≤ 0,01

The maximum arbitrary force of the extensor muscles of the leg in the knee and hip joints (HJ) during the OMC varied within 9,7 %. The average level of manifestation of these abilities for the full cycle was 92,5±4 %. The values shown in phase II were significantly lower than in IV (p≤0,05), and the results in the "critical" phases were below the mean level, but did not differ significantly (p≥0,05). The degree of influence of OMC on the dynamics of this indicator was 28,9 % and was reliable.

The maximum arbitrary muscle strength of the plantar flexor of the foot (PFF) during the OMC varied within 9,9 %. The average level of manifestation of these abilities for the full cycle was 98,3±4 %. At the same time, the values shown in the II and IV phases did not have significant differences, nor were they fixed between the values of the "critical" phases (p≥0,05). The degree of influence of OMC on the dynamics of this indicator was 12,9 % and is reliable (see Table 1). It should be noted that the main difference between the level of manifestation of the power capabilities of the muscles LE and PFF is a less pronounced decrease in the results of the maximum arbitrary muscle strength of the PFF in the II phase.

The explosive force of the LE muscles under isometric mode of operation during the OMC varied within 13,8 %. The average level of manifestation of these opportunities for the full cycle was 91,7±7 %. The values shown in phase II were significantly lower than in IV (p≤0,05), and before and during menstruation – lower than during ovulation. The degree of influence of OMC on the dynamics of this indicator was 17,9 % and is reliable.

In turn, the explosive force of the PFF muscles (manifested in 0,1 s) in the isometric mode of operation during the OMC varied within 9,8 %. The

average level of manifestation of these abilities for the full cycle was 94,7±5 %. At the same time, the values shown in the II and IV phases did not have significant differences (p≥0,05), and the values shown during and before menstruation were significantly lower than during ovulation (p≤0,05). The degree of influence of OMC on the dynamics of this indicator was 22,7 % and was reliable (see Table 1).

The main difference in the manifestation of the starting force between the muscle groups LE and PFF is similar to the differences in the dynamics of the maximum random force, a more significant decrease in the index for the muscle LE in phase II relative to IV. Thus, the explosive strength of the muscles of the lower extremities in the dynamic mode of operation based on the results in the jump upwards (according to Abalakov) during the OMC varied within 7,9 %. The average level of manifestation of these opportunities for the full cycle was 96,8±5 %. The values shown in phase II were significantly lower than in IV (p≤0,05), and the results of the "critical" phases were below the mean, but did not differ significantly (p≥0,1). The degree of influence of OMC on the dynamics of this indicator was 23,6 % and was reliable.

Interesting data were obtained by analyzing the result of a jump upwards with a wave and without a wave of hands, which were performed daily before and after training. When assessing the results of jumps, not only the OMC phase was taken into account, but also the volume, as well as the orientation of the training impacts.

It was revealed (Table 2) that the height of the jump upwards with a wave of hands before training fluctuates on different days of the cycle from 49,8 to 54,3 cm, after training – from 46,6 to 53,9 cm. In both cases, the lowest results were shown in the menstrual (I), and the highest in the postovulatory phase (IV). It is characteristic that in the jumps that were performed after training, the greatest difference was recorded. And if in the II, III, and IV phases, the differences before and after training are statistically insignificant (p>0,05), then in the postmenstrual and, especially, in the menstrual phase, the difference reached 5 % of the significance level.

Thus, we can note a stronger impact of training loads on the speed-strength potential of female athletes during the unfavorable phases of their body's biorhythms. With regard to the ovulatory phase, the differences in the results in the jump up before and after training, with this method of performance, are statistically insignificant (for 5 % significance level) and do not differ (p>0,05) from the indices in the II and III phases of the OMC.

The results of jumps without hands (see Table 2) showed approximately the same picture: the highest values were recorded in the II and IV phases of the cycle, while the low values were recorded in I and III. But, if in jumps with a wave of hands the differences in the indicators in the last phases were significant, then in this method of jumping they are minimal, and the greatest

differences are characteristic for the ovulatory phase. This fact can be explained by the fact that the way to jump upwards without a wave of hands was less familiar for athletes and required certain coordination skills, and in the ovulatory phase, the orientation in space and the mismatch in motor actions can be violated [12, p. 14].

Table 2

Parameters of the height of the jump (in cm) upwards with a wave and without a wave of hands on the phases of the CMC for runners for short distances

Phase of OMC	Jump up with a wave of hands, cm						Jump up without a wave of hands, cm					
	Before training		p	After training		p	Before training		p	After training		p
	X	S		X	S		X	S		X	S	
I	49,8	2,3	-	46,6	2,4	-	39,6	1,8	-	38,9	2,0	-
II	53,6	1,2	<0,05	52,8	1,3	<0,05	43,2	1,3	<0,05	42,9	1,7	<0,05
III	51,3	1,4	>0,05	50,3	1,9	>0,05	40,6	1,7	<0,05	38,3	1,8	<0,05
IV	54,3	1,3	<0,05	53,9	1,8	<0,05	45,2	1,6	<0,05	45,0	1,8	<0,05
V	50,9	2,1	<0,05	47,2	2,2	<0,05	40,9	1,9	<0,05	39,6	2,0	<0,05

When performing jumps with a wave and without a wave of hands, the greatest variability of the indicators was observed in the menstrual phase. And the most significant variation was recorded after training, which is associated with both different in scope and direction of the training load, and with the individual reaction of the athlete's body to it.

Thus, the data of the conducted research testify to the presence of phase changes in the motor performance indicators of athletes during the OMC. It is also established that the dynamics of each of them has its own features, characteristic for this or that phase of the menstrual cycle. These features we associate with the change in the functional state of organs and systems on which the level of manifestation of the various motor abilities of athletes depends.

In turn, high values of the variability of the indices in the I, III and V phases suggest that the level of manifestation of physical qualities in the "critical" phases of the OMC has significant individual characteristics.

The analysis of test results, based on questionnaire Ch. Spielberger – Yu. Khanin in athletes, shows (Table 3) that the level of situational anxiety is high in phase V and statistically significantly ($p<0.05$) differs from the indicator in phase II. The state, clearly perceived and evaluated by the athletes as a clear sense of disquiet, anxiety and fear, manifests itself in the premenstrual phase. In the menstrual phase, the mental state is characterized by a feeling of dissatisfaction, fatigue, some emotional depression or tension. In general, this is confirmed by studies of athletes by HAM (*health, activity, mood*) (Table 4), whose emotional color is negative with a predominance of negative emotions.

Table 3

Indicators of situational anxiety in female athletes (n = 23) in different phases of OMC ($\overline{X}$ ± S)

Conditional units		Phase OMC	The significance of differences Student's criterion (t)				
$\overline{X}$	S		Phase OMC				
			I	II	III	IV	V
39,3	8,3	I	X				
33,2	5,9	II	2,45*	X			
37,1	6,6	III	0,88	2,38*	X		
37,6	7,3	IV	0,45	2,66*	0,62	X	
42,3	7,8	V	0,106	3,28*	1,43	1,52	X

Notes: 1) * – differences are significant at p<0.05;

2) the phase of the OMC: I – menstrual; II – postmenstrual; III –ovulatory; IV – postovulatory; V – premenstrual.

In the postmenstrual phase, the picture changes significantly, and subjectively the athletes assessed their emotional state as the best. At the majority of sportswomen the emotional state is characterized by feeling satisfaction, optimism, aspiration to activity.

Table 4

Indicators of emotional state of the test HAM athletes in the different phases of the OMC ($\overline{X}$ ± S)

HAM, c.u.		Phase OMC	The significance of differences Student's criterion (t)				
$\overline{X}$	S		Phase OMC				
			I	II	III	IV	V
23,7	7,3	I	X				
32,6	6,8	II	2,84**	X			
28,7	6,3	III	1,82	1,62	X		
31,9	7,1	IV	2,62*	0,96	1,60	X	
22,3	6,9	V	0,98	3,26**	2,96**	3,18**	X

Notes: 1) * – differences are significant at p<0.05;

2) the phase of the OMC: I – menstrual; II – postmenstrual; III –ovulatory; IV – postovulatory; V – premenstrual.

In ovulatory phase changes are not so significant. In this phase, it is difficult to determine the predominant direction of emotional reactions. Apparently, in the phase of ovulation in female athletes can be observed,

diametrically opposed emotional states, depending on many external and internal factors. So, in this phase at the same time, there is a fairly high business activity, the desire for activity – on the one hand, and inadequate stubbornness, dissatisfaction, rather high emotional tension – on the other. In the process of interaction, this state is manifested in the initiation of conflicts, resentment, instability.

Postovulatory phase, the characteristics of mental states of athletes in it, is very similar to postmenstrual. Their condition here is characterized by a positive emotional background, some euphoria, desire for new events, impressions.

Thus, according to the results of the analysis of the data obtained, it can be concluded that the most distinct changes in the emotional state, expressed in mood deterioration, an increase in the level of anxiety in athletes are observed in the premenstrual and menstrual phases of the OMC.

Conclusions. Thus, in the course of studying the general tendency of changes in the subjective evaluation of the functional state and manifestation of physical qualities in athletics during the OMC, the data obtained in the studies of other authors were confirmed, the unidirectional wave-like character of the dynamics of the indices from phase to phase of the cycle was proved. The highest values of the studied parameters were noted in the postmenstrual and postovulatory phases (maximum in the postovulatory period), and their decrease in the menstrual, ovulatory and premenstrual phases (minimum during menstruation).

Also, significant differences in the dynamics of the manifestation of individual motor abilities in athletes during the OMC:

– in the average level of manifestation and range of variation of indicators for the full cycle;

– in the ratio between the level of manifestation of physical qualities in the favorable and “critical” periods of the cycle;

– in the degree of influence of menstrual function on the change in the results of individual test exercises during the OMC.

It should be added that the high values of the variability of all the studied indicators in the menstrual, ovulatory and premenstrual phases of the OMC allowed us to assume that the level of manifestation of motor abilities in the “critical” phases of the cycle has significant individual characteristics.

From all of the above mentioned it can be concluded that during the OMC the level of manifestation of motor abilities of athletes varies depending on the phases of the cycle. In our opinion, taking into account this situation in the organization of the mesocycle of a particular athlete, it is possible to increase the productivity of his/her preparation, without unnecessarily increasing the volume and intensity of training influences.

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АНОТАЦІЯ

Врублевський Євген, Кожедуб Марина, Севдалєв Сергій. Вплив біоритміки організму кваліфікованих бігунок на короткі дистанції на динаміку їхніх рухових здібностей.

У статті представлено особливості динаміки суб'єктивної оцінки функціонального стану та прояви рухових здатностей протягом ОМЦ у спортсменок, бігуні на короткі дистанції. Показано, що рівень прояву рухових можливостей спортсменок змінюється відповідно до фаз специфічного біологічного циклу, кожен із яких характеризується тим або іншим станом менструальної функції та організму в цілому. Урахування даного положення при побудові тренерського процесу може підвищити його ефективність без збільшення обсягу та інтенсивності застосовуваних тренувальних впливів.

***Ключові слова**: спортсменки, овариально-менструальний цикл, фази, рухові здібності, індивідуальні особливості.*

РЕЗЮМЕ

Врублевский Евгений, Кожедуб Марина, Севдалев Сергей. Влияние биоритмики организма квалифицированных бегуний на короткие дистанции на динамику их двигательных способностей.

В статье представлены особенности динамики субъективной оценки функционального состояния и проявления двигательных способностей на протяжении ОМЦ у спортсменок, бегуний на короткие дистанции. Показано, что уровень проявления двигательных возможностей спортсменок изменяется в соответствии с фазами специфического биологического цикла, каждая из которых характеризуется тем или иным состоянием менструальной функции и организма в целом. Учет данного положения при построении тренировочного процесса может повысить его эффективность без увеличения объема и интенсивности применяемых тренирующих воздействий.

***Ключевые слова**: спортсменки, овариально-менструальный цикл, фазы, двигательные способности, индивидуальные особенности.*