Journal of Physical Education and Sport ® (JPES), 18(4), Art 360, pp.2389 - 2396, 2018
online ISSN: 2247 - 806X; p-ISSN: 2247 – 8051; ISSN - L = 2247 - 8051 © JPES

Original Article

Comparative analysis of functional capabilities and special working ability of men and women, specializing in 800 m and 1500 m running

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Published online: December 31, 2018
(Accepted for publication December 04, 2018)
DOI:10.7752/jpes.2018.04360

Abstract: The problem of increasing the efficiency of female athletes' training, in accordance with the functional state in different phases of the menstrual cycle, as well as the responses of adaptation mechanisms to specific loads; special performance level of women and men, specializing in running at 800m and 1500m, has been studied. Methods and research organization: analysis and generalization of scientific and methodical literature; questionnaire survey; pedagogical experiment; biomedical and statistical theory methods. The survey involved 13 women and 10 men, specializing in running at 800m and 1500m, at the age of 17-24, who qualified as Candidate Master of Sports (CMS), I and II skill-categories. The state of all athletes' health was within the limits of the physiological norm. Women's studies have been conducted, taking into account phases of the menstrual cycle, simultaneously, men have been examined too. We have noted the highest rates of special working ability among women, as evidenced by the results of female athletes' running of 4*400m training sessions, among female athletes (CMS and I skill-category) in the postmenstrual and postovulatory phases of the menstrual cycle (MC), which surpassed the results in comparison with the menstrual, ovulatory and premenstrual phases; the best results among the female athletes of the II skill-category were recorded in the postmenstrual ($p<0,05$) and postovulatory ($p<0,05$) phases of the MC, the lower running outcome was in the premenstrual, menstrual and ovulatory phases of the MC. The adaptation reactions of the women bodies to the specific activities, aimed at manifestation of anaerobic endurance, are characterized by an optimal functional state in the postovulatory and postmenstrual phases, compared with the menstrual, ovulatory and premenstrual phases of the MC. It was determined that among the CMS and I skill-category male athletes, the best result of running 4*400m training session was in the third and fifth micro cycles, somewhat lower result was in the first and second micro cycles, and it decreased in the fourth macrocycle; Athletes of the II skill-category had lower results in the second ($p<0.05$) and fourth, growing in the third and fifth micro cycles. The adaptation reactions of the male bodies to the specific activities, aimed at manifestation of anaerobic endurance, are characterized by an optimal functional state in the first, second, third and fifth micro cycles, with the slight decrease in the fourth micro cycle.
Keywords: functional state, lactic acid, glucose, hemoglobin, frequency of cardiac contractions, mesocycle, menstrual cycle.

Introduction.

Modern sport is characterized by the steady growth of sports achievements, accompanied by an increase in the volumes and intensity of the training load. Such an approach to the training process often leads to the regulatory systems' over-strain, exhaution of the adaptation reserve and the reduction of the athlete's performance terms, which doesn't allow to achieve high sports results.

The question of optimal construction and improvement of the athletes' training process, taking into account their functional state, becomes of increasing importance. V.N. Platonov devoted a significant number of studies to the research of these issues, 2013 At present, women's training is conducted under the men's training program. Functional systems, adaptive processes in the female body differ from those in the male body. This is due to one of the main biological features of the female body, associated with reproductive function, accompanied by significant changes in the hormonal status, causing various functionalities, changes in general and special working in different phases of the menstrual cycle.

A series of studies (L.Y.G. Shakhlina, 1995-2014, S.V. Kalytka, 2001; O. B. Roda), among which are foreign researchers A.M. Burrows, S.R. Bird, 2005; S.B. Da Silva, 2006; A.J. Anderson, M.A. Babcock, 2008, is devoted to the study of the reproductive hormones' influence on the functional state, adaptive reactions and manifestation of physical qualities in the sports training system for women.

Determining the degree of the cardiovascular system's adaptation to the various factors and assessing the adequacy of regulatory processes in terms of the heart rate variability in a state of relative rest, we used the

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indices, offered by R.M. Baevsky (2001). It has been established that for women, the state of cardiovascular system and the dynamics of physical fitness display PWC_{170} is cyclical and depends on changes in the hormonal status of their body during the menstrual cycle (MC). The highest indices of the regulatory systems' stress regulatory index were in the premenstrual phase; their decrease was observed during menstrual, postmenstrual and ovulatory phases. Plausibly lower rates are recorded in the postovulatory ($p<0.05$) phase, which indicates a decrease in the sympathetic system's influence on the heart rhythm, and consequently, the reduction of the regulatory systems' intensity and the increase of the cardiovascular system's functional capabilities of female athletes in these phases, compared to the premenstrual phase. This reflects on the physical working capacity (PWC_{170}, $kg \cdot min^{-1} \cdot kg^{-1}$). Significantly higher rates of PWC_{170} were recorded among female athletes in the post-menstrual and post-ovulatory phases, compared with the menstrual, ovulatory and premenstrual ones.

Among men, the higher rates of the regulatory systems' stress regulatory index were in the first, fourth, and plausibly higher in the second ($p<0.05$), micro cycles, and much lower – in the third and fifth micro cycles, indicating a decrease in sympathetic effects on the heart rhythm and the degree of regulatory systems' tension and enhancement of the cardiovascular system's functional capabilities of the male athletes in these micro cycles. PWC_{170} indices among men tended to gradually increase during the first three micro circles, plausibly decreasing during the fourth ($p>0.05$, compared with the third micro cycle) and increase in the fifth micro cycle. Consequently, the physical working ability of men depends on the state of the cardiorespiratory system and the level of athletes' adaptation to the training load.

The problem of the female athletes' training activities efficiency increase in accordance with the functional state in different phases of the MC, as well as the responses of the adaptation mechanisms to specific loads, special training and, accordingly, the construction of training mesocycles for women and men, specializing in running at 800m and 1500m, remains poorly studied. The relevance of our research is due to this.

The purpose of the research is to study the dynamics of functional capabilities and special ability of qualified athletes, specializing in running at 800m and 1500m during the mesocycle.

Materials and methods

The survey involved 13 women (3 – CMS, 5 – I skill-category, 5 – II skill-category) and 10 men (2 – CMS, 2 – I skill-category, 6 – II skill-category), from 17 to 24 years old, specializing in medium distances running. The state of all athletes' health was within the limits of the physiological norm. All female athletes did not take any contraceptives and had normal menstrual flow. Using MC as a natural biological model for studying the effect of hormonal status on special working ability, the functions of vegetative systems, biochemical processes of the athletes' bodies, the study was conducted in each phase of MC. In the female body, due to the maturation of the ovum in the ovary and subsequent ovulation, the concentration of reproductive hormones changes cyclically, which makes it possible to conditionally divide the MC into phases. Daily measurements of basal axillary temperature made it possible to simultaneously determine the ovulation phase with the subsequent calculation of five phases of the MC. The phases of the MC are divided as follows: Phase I – menstrual (days 1-5 of the cycle); Phase II – postmenstrual (days 6-12 of the cycle); III phase – ovulatory (days 13-15 of the cycle); IV phase – post ovulatory (days 16-24 of the cycle); V phase – premenstrual (days 25-27 of the cycle), Shakhlina L. (2000). Women testing has been carried out, taking into account the MC phases, simultaneously, men have also been examined. The study lasted for two months.

In order to assess the level of anaerobic and aerobic capabilities of the athletes, specializing in running at 800m and 1500m, a test was used – 4x400m training sessions with a gradual increase in speed for each segment and a rest interval of 5 minutes. Research among women was conducted in each phase of MC, simultaneously, with similar studies carried out among men. The function of the cardiovascular system was judged by the heart rate (beats per minute) both during rest, after exercise and during recovery. Monitoring of heart rate was performed with the help of the training tool Polar S610i (Finland).

Determination of the lactate concentration in the bloodstream is an important indicator of the intensity of loading, one of the main methods of operational control over the effectiveness of the training process, which provides information about changes in blood, muscle, and other tissues. To establish the concentration of lactate in the blood of athletes, specializing in running at 800m and 1500m, five 4x400m control races during the mesocycle have been conducted, since the maximum amount of lactate in the blood accumulates after overcoming the distance of 400m. Lactate was measured by using test-strips BM-Lactate Lactate No.25 by Accutrend Plus tool (Switzerland).

Biochemical researches for the glucose and hemoglobin determination were performed, using the standard method of taking blood samples from the phalanx of the fingers by the highest category paramedic. Blood glucose is regulated by the liver that secretes or absorbs it, depending on the intensity of the load, the action and the concentration of hormones. Hemoglobin composes 95% red blood cell protein. The hemoglobin molecule consists of two different pairs in the structure of the chain of globin protein, each of which contains an iron-containing group - gem. The norm for men is 130-170 $g \cdot l^{-1}$, for women – 120-160 $g \cdot l^{-1}$. The level of hemoglobin in the blood of the athletes, specializing in running at 800m and 1500m is an indicator of the body's aerobic capacity and degree of adaptation to the load.

The processing of quantitative indices of the female athletes' survey results was carried out by statistical processing of the received digital data on a personal computer with the help of variable-based, dispersion analysis (Statistica program). The average value of the indices ($\overline{X}$) has been calculated, standard error (m).

Results.

To determine the optimal construction of base mesocycles for men and women, specializing in medium distance running, we have conducted a comprehensive study in the mesocycle of a planned training process, consisting of five striking micro circuits that contained three trainings with significant loads and were identical in their construction. The amount and intensity of the training load for each individual athlete have been the same and corresponded to their preparedness and functionality. This mesocycle structure was chosen to study the formation of a delayed training effect.

We have used training tools that mainly develop speed and anaerobic-aerobic capabilities on the first, third and fifth days of the micro cycle. On the second, fourth and sixth days the tools to develop endurance and aerobic capacity, speed and strength have been used. The seventh day was dedicated to the rest and recovery.

To determine the special efficiency in each micro cycle, we have used a test with repeated loads – 4 rounds of 400 m with a 5 minutes rest in between, which is most often used in the training process of stayers. The highest results were demonstrated by all female athletes in the postmenstrual and postovulatory phases of the MC, indicating a high specific working ability. Plausibly lower running result, especially among the female athletes of the II skill-category, was recorded in premenstrual ($p<0.05$), menstrual ($p<0.05$) and ovulatory ($p<0.05$) phases of the MC (Table 1). Consequently, changes in the hormonal status that occur during the MC have a significant effect on the special working ability of women, who specialize in medium-distance running.

Table 1. Special working ability dynamics of women, specializing in running at 800m and 1500m, during different phases of the MC

Results of running the distance (4x400m), *s*		MC Phase				
		I	II	III	IV	V
CMS, Category I	1	74,87±5,91	72,64±5,79	73,01±5,61	72,42±5,72	73,77±5,06
	2	74,32±5,61♦	72,23±6,11	73,50±5,79	71,51±5,03	72,87±8,01
	3	74,21±5,43	73,21±7,05	73,71±5,55	71,85±5,67	74,29±5,53
	4	75,31±7,81♦	71,25±6,38	72,28±5,69	70,53±5,06	73,48±5,97
Category II	1	88,58±9,00	86,78±7,60	88,34±9,17	86,48±7,81	87,00±10,16
	2	90,48±9,51♦	86,48±7,82*	89,08±10,23*♦	86,10±8,48*	92,16±11,04♦
	3	90,98±9,98♦	85,76±7,95*	89,16±10,54*	85,68±7,62*	92,38±11,06♦
	4	91,42±11,61♦	82,12±10,07*	85,74±12,62♦	83,12±10,19*	87,12±12,99♦

Notes: * – ($p<0.05$) – plausible result changes, comparing to the premenstrual phase of the MC; ♦ – ($p<0,05$) – plausible result changes, comparing to the postovulatory phase of the MC

During the athletes' running the 4x400m test intervals, the heart rate, hemoglobin concentration, lactate and blood glucose have been measured. For women, the functional value of the performed work is lower, indicated by a plausible heart rate, in the postmenstrual ($p<0.05$) and postovulatory ($p<0.05$) phases, compared to the menstrual, ovulatory and premenstrual phases, which explains the effectiveness and efficiency of the heart rate work. Significantly lower indices of heart $rate_{max}$ have been recorded, when female athletes were overcoming the fourth section in the postmenstrual and postovulatory phases ($p<0.01$), comparing to the premenstrual (Table 2). The heart $rate_{max}$ was high in the menstrual and ovulatory phases of the MC.

Table 2. Heart $rate_{max}$ indices' dynamics of women, specializing in running at 800m and 1500m, during different phases of the MC.

Indicator heart $rate_{max}$ on segments (4x400 m), *beats·min* $^{-1}$		MC Phase				
		I	II	III	IV	V
CMS, Category I	Heart $rate_{max}$ 1	179,87±2,09	177,00±1,44*	176,87±2,60	176,62±1,40*	178,75±2,14
	Heart $rate_{max}$ 2	180,75±2,12	176,12±1,85*♦	176,75±2,46	179,00±2,23	180,25±1,99
	Heart $rate_{max}$ 3	180,12±1,82	175,37±2,29*♦	177,50±2,79	178,12±1,42	179,75±1,94
	Heart $rate_{max}$ 4	181,00±2,54	177,88±2,12**	180,87±3,18	178,75±1,49**	182,00±2,03
Category II	Heart $rate_{max}$ 1	182,20±1,98	177,20±1,28	180,00±1,52	175,80±2,80	182,60±1,36
	Heart $rate_{max}$ 2	181,00±2,85	178,80±1,16	179,80±2,11	177,40±1,94	182,60±1,74
	Heart $rate_{max}$ 3	182,40±2,96	179,20±1,53	180,00±1,45	178,40±1,60	181,80±3,76
	Heart $rate_{max}$ 4	185,60±3,29	181,60±1,63	183,40±2,16	180,20±2,58	187,00±1,92*♦

Notes: * – ($p<0.05$), ** – ($p<0,01$) – plausible result changes, comparing to the premenstrual phase of the MC; ♦ – ($p<0,05$) – plausible result changes, comparing to the postovulatory phase of the MC

For the II skill-category female athletes, the heart rate$_{max}$ in the premenstrual phase was the highest while overcoming the fourth segment and plausibly higher, comparing to the postmenstrual, ovulation and postovulatory ($p<0.05$) phases. The concentration of lactate in the blood was plausibly lower in the postmenstrual and postovulatory phases, comparing to the menstrual, ovulation and premenstrual, indicating its lower formation and quicker utilization during the work. After the CMS and the I skill-category female athletes finished the last segment with the increased intensity of loading, the concentration of lactate increased in the menstrual, postmenstrual, and ovulatory phases, reached the highest level in the premenstrual phase, which is plausibly higher ($p<0.05$) than in the postovulatory phase of the MC (Fig. 1).

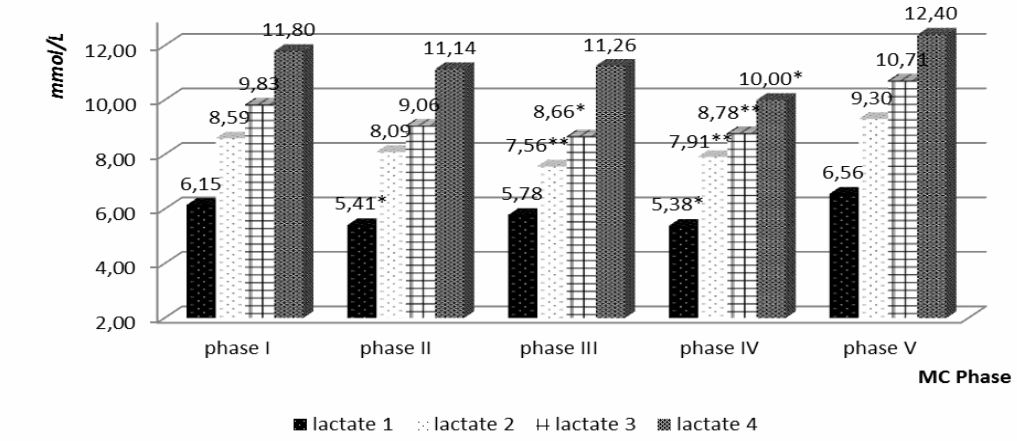

Fig.1. Dynamics of lactate indices in women blood in different MC phases

Notes: * – ($p<0.05$), ** – ($p<0,01$) – plausible result changes, comparing to the premenstrual phase of the MC

Lactate in the bodies of the II skill-category female athletes in the postmenstrual and postovulatory phases was lower after passing the last section, its concentration was higher in the premenstrual phase, and plausibly higher indices of lactate have been noted in menstrual ($p<0.05$) and ovulatory ($p<0.05$) phases, compared with the postovulatory phase of the MC (Fig. 2).

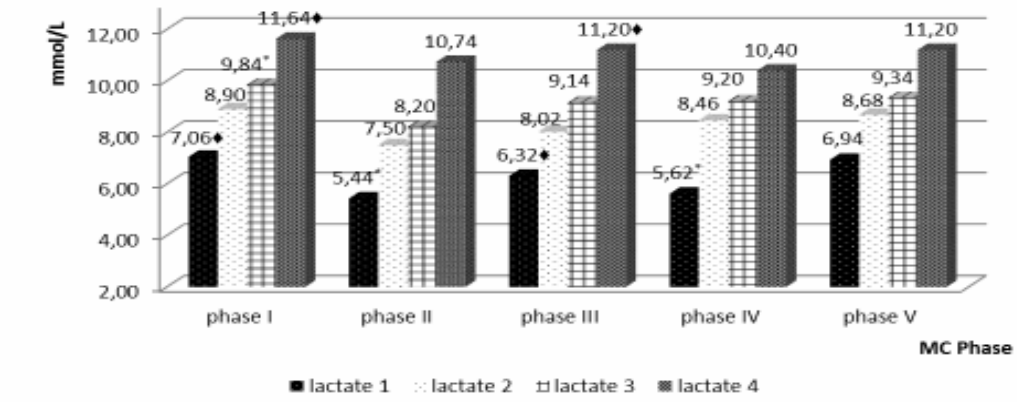

Fig.2. Dynamics of lactate indices in women blood in different MC phases (II skill-category)

Notes: * – ($p<0.05$) – plausible result changes, comparing to the premenstrual phase of the MC; ♦ – ($p<0.05$) – plausible result changes, comparing to the postovulatory phase of the MC

The highest concentration of glucose in the blood of female athletes of CMS and I skill-category (Chart) was recorded before the training in the menstrual phase and statistically plausible changes in the postmenstrual and ovulatory ($p<0.05$) phases, comparing to the premenstrual.

After training, the glucose in the blood increased in the menstrual and postovulatory phases and was significantly higher in the premenstrual phase, comparing to the postmenstrual ($p<0.05$) and ovulatory ($p<0.01$) phases. For the II skill-category female athletes (Chart), before the training glucose was high in the menstrual phase and was plausibly higher in premenstrual, comparing to the ovulatory ($p<0.05$). A slightly lower glucose level was noted in the postovulatory and postmenstrual phases.

After finishing all the sections, more intensive consumption of glucose and formation of lactate was noticed in the premenstrual and, especially, menstrual phases, comparing to the ovulatory ($p<0.05$), postmenstrual ($p<0.05$) and postovulatory ($p<0.05$) phases of the MC (Table 3).

Table 3. Dynamics of glucose indices in women blood in different MC phases

Glucose level, *mmol/l*$^{-1}$		MC Phase				
		I	II	III	IV	V
CMS, Category I	before training	4,34±0,24	3,81±0,13*	3,73±0,12*	4,00±0,20	4,19±0,26
	after training	6,00±0,21	5,23±0,41*	5,43±0,53**	6,00±0,12	6,25±0,56
Category II	before training	4,48±0,40	3,80±0,13	3,66±0,19*	3,80±0,11	4,24±0,23
	after training	5,80±0,23♦	4,34±0,11*	4,80±0,32	4,34±0,27*	5,54±0,10

Notes: * – ($p<0.05$), ** – ($p<0,01$) – plausible result changes, comparing to the premenstrual phase of the MC; ♦ – ($p<0.05$) – plausible result changes, comparing to the postovulatory phase of the MC

We have determined the higher hemoglobin indices in the postovulatory phase, comparing to the other phases (Table 4). The decrease of the hemoglobin content in the menstrual, postmenstrual and ovulatory phases, especially for the female athletes of the II skill-category ($p<0.05$), predisposes the predominance of anaerobic sources of the given training work provision, reduces the speed of the heart rate recovery and lactate utilization (Chart).

Table 4. Dynamics of hemoglobin indices in women blood in different MC phases

Hemoglobin level, *g·l*$^{-1}$		MC Phase				
		I	II	III	IV	V
CMS, Category I	before training	131,00±2,26	128,65±1,92	133,50±1,51	137,50±3,98	132,75±2,39
	after training	130,50±2,27	127,37±2,66	134,75±1,78	138,87±3,31	135,25±2,84
Category II	before training	120,00±4,34	119,20±5,52*	118,80±6,01*♦	124,60±7,26	121,60±5,63
	after training	120,40±3,96♦	120,00±4,60*♦	118,60±5,91*♦	129,60±5,71	127,00±6,17

Notes: * – ($p<0.05$) – plausible result changes, comparing to the premenstrual phase of the MC; ♦ – ($p<0.05$) – plausible result changes, comparing to the postovulatory phase of the MC

It was determined that the male athletes of CMS and I skill-category had the best result in the third and fifth micro cycles, somewhat lower in the first and second ones and decreased in the fourth micro cycle.

The lowest results for athletes of II skill-category were in the second ($p<0.05$) and fourth micro cycles, and the highest were in the third and fifth micro cycles (Table 5).

Table 5. Dynamics of the special working ability of men, specializing in running at 800m and 1500m, during the mesocycle

Results of running the distance (4x400 m), s		Micro cycle				
		I	II	III	IV	V
CMS, Category I	1	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
Category II	1	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

Notes: * – ($p<0.05$) – plausible result changes, comparing to the III micro cycle. For men, the functional value of the performed work did not have any significant changes during the mesocycle. Athletes of the CMS and I skill-category have a slight increase in the heart rate in the fourth microscope.

Athletes of the II skill-category had higher rates of heart rate$_{max}$ than the CMS and I skill-category athletes (Chart) (Table 6).

Table 6. Dynamics of the heart rate$_{max}$ indices of men, specializing in running at 800m and 1500m, during different mesocycles

Indicator heart rate$_{max}$ on segments (4x400 m), *beats·min* $^{-1}$		Micro cycle				
		I	II	III	IV	V
CMS, Category I	Heart rate$_{max}$ 1	179,40±3,50	180,20±4,33	180,00±4,48	183,00±5,52	177,80±2,46
	Heart rate$_{max}$ 2	181,60±2,09	182,20±3,34	182,00±3,56	183,80±4,42	180,00±1,58
	Heart rate$_{max}$ 3	183,40±1,08	182,80±2,15	183,40±1,92	186,40±1,63	184,80±1,07
	Heart rate$_{max}$ 4	186,80±1,07	186,00±1,79	187,40±1,74	187,40±1,80	188,60±2,18
Category II	Heart rate$_{max}$ 1	186,00±6,54	184,80±3,36*	179,60±1,69	182,80±3,48	180,20±1,46
	Heart rate$_{max}$ 2	185,40±3,26	187,00±3,53	183,00±2,28	185,40±3,20	183,00±2,28
	Heart rate$_{max}$ 3	188,00±3,70	190,00±3,25	187,40±1,99	187,80±2,92	185,60±2,50
	Heart rate$_{max}$ 4	190,60±3,65	190,00±2,47	189,40±2,20	189,60±2,92	189,40±2,38

Notes: * – ($p<0.05$) – plausible result changes, comparing to the III micro cycle.

The level of lactate in the blood indicates that the anaerobic energy supply of the training work was at a relatively uniform level throughout all micro cycles. For all the male athletes, lactate level indices have been slightly lower in the second micro cycle (Fig. 3, 4).

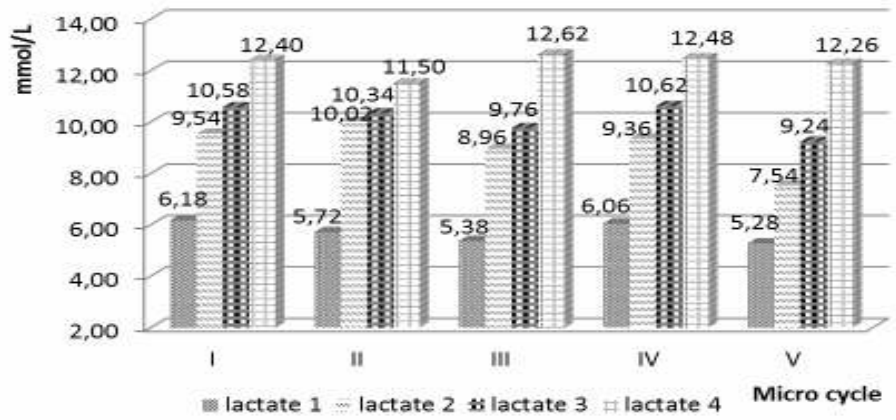

Fig. 3. Dynamics of the lactate indices in the blood of men, specializing in medium distance running (CMS and I skill-category)

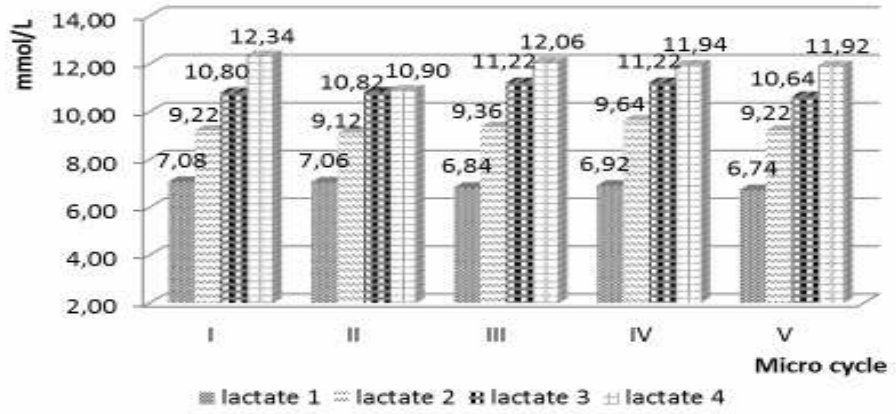

Fig. 4. Dynamics of the lactate indices in the blood of men, specializing in running at 800m and 1500m (II skill-category)

The level of glucose in the blood indicates that carbohydrate consumption was at a relatively uniform level throughout all micro circles. For all the male athletes, glucose indices did not have any significant changes throughout all micro circles (Table 7).

Table 7. Dynamics of the glucose indices in the blood of men, specializing in running at 800m and 1500m

Glucose level, *mmol/l*$^{-1}$		Micro cycle				
		I	II	III	IV	V
CMS, Category I	before training	4,54±0,27	4,48±0,34	4,24±0,42	4,28±0,44	4,40±0,46
	after training	5,74±0,07	5,64±0,12	5,62±0,12	5,44±0,55	5,24±0,69
Category II	before training	4,12±0,32	4,34±0,20	4,06±0,29	3,82±0,26	3,94±0,25
	after training	5,00±0,26	5,22±0,27	5,38±0,20	4,94±0,31	4,90±0,23

Hemoglobin amount in the blood of the CMS and I skill-category male athletes was higher in the first, second and third micro cycles and plausibly decreased in the fourth and fifth micro cycles. It should be noted that for men after training hemoglobin did not significantly increase. Thus, the highest were the indices in the first and second micro cycles. A slightly lower level was in the third, fourth and fifth micro cycles (Table 8).

Table 8. Dynamics of the glucose indices in the blood of men, specializing in medium distance running.

Hemoglobin level, *g·l*$^{-1}$		Micro cycle				
		I	II	III	IV	V
CMS, Category I	before training	154,80±5,36	154,60±4,20	154,20±2,87	151,20±2,74	151,20±3,06
	after training	156,00±4,78	155,20±3,55	152,80±2,85	152,60±2,96	152,20±3,29
Category II	before training	154,00±6,35	155,20±6,06	154,20±4,18	152,00±3,30	153,80±2,90
	after training	157,00±7,61	158,40±7,30	156,80±5,99	157,20±5,82	158,20±4,89

The hemoglobin amount in the blood of II skill-category male athletes before the training was high in the first, second, third micro cycles, and somewhat lower – in the fourth and fifth. After finishing the training load, hemoglobin gain was significant in all micro circles, especially in the fourth and fifth ones.

Discussion.

It has been established that in the postmenstrual and postovulatory phases of the MC, the functional state of the heart rate of athletes has improved significantly, as evidenced by the heart rate variability indices: the level of the heart rhythm regulatory systems activity has increased due to the predominance of the parasympathetic level of regulation over the sympathetic one. The functional value of the performed work, assessed by the average heart rate and the heart $rate_{max}$, declined, which indicates the efficiency of the heart rate. The level of lactate in the blood is the lowest, which indicates its high utilization during the work; lesser increase in glucose – the efficiency of energy supply. Significant growth of hemoglobin in the postovulatory phase improves the delivery of oxygen to working muscles, thereby accelerating the recovery of the heart rate and lowering the level of lactate in the blood during the recovery. In the ovulatory phase, a slight decrease in vegetative regulation, a slight increase in the sympathetic level of regulation leads to a slight decrease in the functional state of the heart rate, which reflects in the performance of female athletes, being slightly decreased, compared with the postmenstrual and postovulatory phases of the MC. A slight increase in heart $rate_{max}$, lactate level and glucose concentration in the blood during the sections passing was determined, compared with the postmenstrual and postovulatory phases of the MC. Reducing the hemoglobin amount leads to the predominance of anaerobic sources of the prescribed training provision, reduces the rate of the heart rate recovery and the lactate utilization. In the premenstrual and menstrual phases of the MC, a significant reduction in the level of vegetative regulation, an increase in the sympathetic level of regulation leads to the strain of the regulatory systems, a decrease in the heart rate functional state, reflected in the decline in the performance. Significant growth of the heart rate $frequency_{max}$ indicates the high functional value of the performed work. High levels of lactate and glucose in the blood indicate the stress of metabolic processes in the body. Reduction of the erythrocytes and hemoglobin in the menstrual phase leads to a decrease in the oxygen delivery to the muscles and the inclusion of anaerobic energy supply, while reducing the rate of the heart rate recovery and lactate utilization. Thus, the highest level of lactate concentration in women's blood has been recorded in the menstrual and premenstrual phases, and the lowest – in the postmenstrual, ovulatory, and postovulatory. This indicates an increase in the contribution of anaerobic processes to the energy supply of the performed work, which leads to the stress of the adaptive processes of the body, when female athletes are overcoming distances in the menstrual and premenstrual phases of the MC, compared with the postmenstrual, ovulatory and postovulatory ones. Consequently, changes in the hormonal status that occur during the MC have a significant effect on the energy supply of the female athletes, which significantly affects the special working ability, which was the highest in the postmenstrual and postovulatory phases of the MC, compared with menstrual, ovulatory and premenstrual.

The significant growth of hemoglobin in the postovulatory phase improved the oxygen flow to the functioning muscles, thereby accelerating the recovery of heart rate and lowering the level of lactate in the blood during the recovery. We also note a plausibly lower hemoglobin level in the menstrual, postmenstrual and ovulatory phases of the MC, compared to postovulatory, where hemoglobin elevations were to 129,60±12,78 $g \cdot l^{-1}$, which in our opinion, reflects a positive training effect on the female athletes' bodies. Having determined the amount of hemoglobin in the blood before the beginning of the training and after the completion of the rehabilitation work, it can be stated that a significant increase occurred in the postovulatory and premenstrual phases of the MC; in menstrual and postmenstrual its decrease was recorded for the CMS and I skill-category female athletes, and in the ovulation phase – a sharp decline for the II skill-category female athletes. The decrease in hemoglobin amount in the menstrual phase may be due to menstrual blood loss. In the postmenstrual phase, estrogen suppresses erythropoiesis, so the hemoglobin content is the lowest. Progesterone, whose level rises starting from the ovulation phase, stimulates erythropoiesis, therefore, somewhat higher hemoglobin values before and after training were defined in the ovulatory, postovulatory and premenstrual phases.

For men, the functional state of the heart rate improved during the first three micro circles, as indicated by the parameters of the heart rate variability: the level of the vegetative regulation activity gradually increased due to the predominance of the parasympathetic level of regulation over the sympathetic. During these micro cycles, physical and special working ability increased, indicating an effective adaptation to physical activity. Such tendency of athletic performance V. M. Platonov observed in his works, 2015.

Thus, the growth of the performance during the first, third and fifth micro cycles is due to an increase in the anaerobic aerobic capacity of the athlete's body, which is a consequence of the training load positive effect on the adaptation processes in these micro cycles. In the fourth micro cycle, a slight decline in the functional state of the heart rate, which is reflected in lowering the level of vegetative regulation, and increasing the sympathetic level of regulation, the tension of regulatory systems, which leads to a decrease in the special working ability and an onset of fatigue. Reduction of the performance in the fourth micro cycle may be due to the appearance of fatigue, failure to recover after heavy loads in the previous micro cycles. In the fifth micro cycle, a slight improvement of the functional state of the heart rate was observed: the increase in the level of vegetative regulation due to the predominance of the parasympathetic link of regulation over the sympathetic, which led to the increased efficiency. The functional value of the performed work did not have any significant changes during the meso cycle, but lower heart rate $frequency_{max}$ indices have been recorded in the third micro cycle, and higher – in the fourth one. The level of glucose and lactate in the blood indicates that the energy

supply of the training work has been at a relatively equal level. Hemoglobin amount in the blood of the CMS and I skill-category male athletes was higher in the first, second and third micro cycles and somewhat decreased in the fourth and fifth micro cycles. The reduction of hemoglobin the level for these athletes after completing training in the third micro cycle is probably associated with an increase in fatigue due to the performed work in the previous micro cycles. This is reflected in the reduction of the special working capacity and functionality of the heart rate.

Conclusions

Our research, conducted, suggests that the adaptive capabilities of the female body to specific loads of athletes, specializing in running at 800m and 1500m depend on the hormonal status during the MC. It has been established that the postovulatory and postmenstrual phases of the cycle are optimal for the manifestation – development of anaerobic-aerobic endurance, which is confirmed by the differences in the functional capabilities of the female athletes' bodies in each phase of the MC. This fact needs to be taken into consideration when planning re-training loads for female athletes, specializing in medium-distance running. Redistribution of training loads by volume and intensity, taking into account the functional capabilities of the female athletes' bodies in different phases of the MC, will enable the trainer to fulfill his planned 100% load, while maintaining the health of athletes, and thus create conditions for achieving high sports results, to keep their sports longevity.

Thus, it has been determined that for men, who specialize in running at 800m and 1500m, the functional capabilities of the heart rate and, consequently, the special working ability increase as a result of adaptation to the increasing training load during the first three striking micro circles. In the fourth micro cycle, the decline in functional capacity and disability is associated with an onset of tiredness as a result of a long and intense training load in the subsequent striking micro cycles. During the fifth micro cycle, the functionality and capacity increased, possibly, due to the rehabilitation of the body after the intensity of the training load was lowered in the fourth micro cycle. Therefore, the dynamics of adaptive reactions must be taken into account when constructing the mesocycles of the male training process, who specialize in running at 800m and 1500m.

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