Biological foundations of optimization of training loads of athletes

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Postgraduate student **Mintszyunke Shan**[1]
M.S. Kozhedub[1]
Dr. Hab., Professor **E.P. Vrublevskiy**[1, 2]
[1]Skorina Gomel State University, Gomel, Belarus
[2]Smolensk State University of Sports, Smolensk, Russia

Corresponding author: vru-evg@yandex.ru

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Abstract

Objective of the study was to consisted in studying the main approaches of the coaches of Belarus and China to taking into account the biorhythmological characteristics of the athletes' body when planning their training process and determining the dynamics of the manifestation of speed and strength abilities during the OMC among athletes specializing in various sports.

Methods and structure of the study. A questionnaire was developed and a survey was conducted of coaches (n=16) involved in the training of track and field athletes in the Republic of Belarus and specialists (n=12) who train hockey players in China. Also, to determine the well-being, changes in mental state, performance, tolerance of training and competitive loads in various phases of the body's biorhythmics, a survey and testing of 18 qualified Belarusian runners at various distances and 23 Chinese female athletes involved in hockey were conducted.

Results and conclusions. Analyzing the data of the coaches' questionnaire, it can be stated that most specialists, when planning the training process, do not take into account the phase of the ovarian-menstrual cycle of athletes, which negatively affects the tolerability of the proposed loads, the functional state and well-being of girls. The results of the survey and the results of testing of athletes indicate the presence of significant phase changes in the indicators of motor abilities of runners and hockey players in each of the phases of the OMC.

Keywords: *sportswomen, training, questioning, features of the female body, OMC.*

Introduction. It is known that the adaptation processes and activity of functional systems in the female body differ from those in men, which is due to the main biological feature of the female body - the presence of the reproductive function, which is quite complex in its neurohumoral regulation [4, 5]. Research by many authors has shown that the cyclicity of the ongoing processes corresponds to the phases of the biological rhythm and affects not only the general condition of the female body, but also its individual organs and systems, which largely determines the performance and the extent of the manifestation of motor qualities in female athletes [2, 3, 6, 7]. Thus, it is obvious that in practical activities, coaches need to take into account the biorhythmological features of the body of a particular athlete, which significantly affect athletic performance.

Objective of the study was to study of the main approaches of coaches from Belarus and China to taking into account the biorhythmological characteristics of the body of female athletes when planning their training process and determining the dynamics of the manifestation of speed-strength abilities during the OMC in athletes specializing in various sports.

Methods and structure of the study. A questionnaire was developed and a survey was conducted among coaches (n=16) involved in training female athletes in the Republic of Belarus and specialists (n=12) who train female hockey players in China. Also, to determine self-assessment of well-being, changes in mental state, performance, tolerance of training and competitive loads in various phases of the body's biorhythms, a questionnaire and testing were conducted among 18 qualified Belarusian runners of

various distances and 23 Chinese athletes involved in hockey. The age of the subjects is 16-20 years, and their sports experience is 3-9 years.

Results of the study and discussion. The analysis of questionnaires of coaches from Belarus and China allowed us to obtain the following data. Thus, 68.8% of the surveyed Belarusian and 58,3% of Chinese specialists, when planning their work, do not take into account the phases of the female athletes' menstrual cycle. Accordingly, 12,5 and 16,7 percent do take into account, and 18,8 and 25,0% use information about the cycle partially, depending on the characteristics of its course. It is characteristic that 75,0% of respondents from Belarus and 83,3% from China are convinced of the mandatory conduct of training sessions in the menstrual phase, the rest do not see the need for this or approach the solution of this issue individually, depending on the athlete's well-being.

The respondents expressed the following opinions on the optimal amount of load in the menstrual phase of the menstrual cycle. Thus, 43,8% of Belarusian and 41,7% of Chinese coaches believe that training impacts during this period should be reduced by half, respectively 25,0 and 16,7% reduce the volume of the load by 20-30 percent from the maximum, the remaining respondents of the two countries do not change the planned volume depending on the psychophysiological and physical condition of the athletes. It was revealed that 56,3% of Belarusian and 58,3% of Chinese coaches consider the use of imitation exercises of a technical nature, aimed to a greater extent at developing flexibility, to be effective in the menstrual phase. At the same time, 18,8% of runners' coaches and 25,0% of hockey players believe that general physical training classes are more productive in this phase. Without exception, all Belarusian and Chinese specialists note the presence of psychophysiological changes occurring in the body of female athletes in the menstrual and, especially, in the premenstrual phase. Most often (as indicated by 81,3% of coaches in Belarus and 66,7% of coaches in China), this manifests itself in the fact that their trainees become irritable and psychologically unstable. Some athletes (18,8 and 16,7%, respectively) experience some lethargy, apathy towards the training process, lack of confidence in their abilities, and sometimes fear and reluctance to participate in competitions. Many coaches (56,3% of Belarusian and 66,7% of Chinese) have personal experience working with athletes whose OMC has virtually no effect on the effectiveness of the training process. The remaining specialists in the two countries claim that absolutely all of their trainees are significantly susceptible to the impact of the body's biorhythms on sports activities. 75,0% of the surveyed specialists in Belarus and 83,3% in China confidently stated that a female athlete with somatic and psychological properties typical of men can achieve success in sports.

Thus, the coaches of the two countries do not have a single conceptual opinion in the approach to planning the educational and training process of female athletes in terms of biorhythmological features of the body and determining the optimal state in which it is possible to set the necessary training effects.

To study the course of the menstrual function and its relationship with the psychophysiological state of girls in various phases of the body's biorhythms, a survey of female athletes from two countries was conducted. During the experiment, they recorded the state of the body in self-monitoring diaries every day, and we kept a log of the subjects' biological cycle.

An analysis of the questionnaire data shows that the RB runners began to play sports at 10,3 years old, the PRC hockey players at 9,5 years old, and the OMC stabilized in most girls from both countries by the age of 14-15. The duration of the OMC in 55,6% of runners and 56,5% of hockey players is 27-29 days. Accordingly, 22,2% and 30,4% have 23-26 days, 16,7% and 8,7% have 21-22 days, and 5,6% and 4,3% have more than 30 days.

It should be emphasized that a shortened OMC (21-22 days) is difficult in itself for planning the training process, and the presence of any violations of the specific biological cycle in an athlete exacerbates these difficulties.

The duration of menstruation in 68,3% of all surveyed athletes is five days, 14,6% - four days, 9,8% - three days, 7,3% - six to seven days. At the same time, 85,4% of athletes feel worse before and during menstruation, pain in the pelvis, headaches. Reduced performance accompanies the premenstrual phase in 65,9 percent of respondents and the menstrual phase in 87,8 percent of respondents. All athletes participate in competitions regardless of the cycle phase, however, 85,4% of girls note that during menstruation this causes faster and deeper fatigue, and the recovery process takes longer than usual.

Analysis of data on the psycho-emotional state showed the following. 26,8% of respondents complain of increased fatigue, imbalance and unreasonable irritability in the first phase (menstrual), 4,9% in the second (postmenstrual), 12,2% in the third (ovulatory), 7,3% in the fourth (postovulatory) and 48,8% in the fifth (premenstrual). According to the subjective feelings of female hockey players, their physical and emotional state worsens in the ovulatory, premenstrual and menstrual phases of the cycle, against which precise spatial orientation decreases, muscle sensations worsen, the time when athletes play slowly increases, and, consequently, the performance of individual players and the team as a whole decreases. As for runners, according to their perception, the best manifestation of special motor qualities is expressed in the II and, especially, IV phases of the cycle, while in the I, III and V phases there is a decrease in the implementation of dominant abilities. It is characteristic that, according to research data [1, 3, 7], it is the postmenstrual (II) and postovulatory (IV) phases of the cycle that are characterized by a high level of hormone concentration. Interesting data were obtained when analyzing the results of the Abalakov vertical jump, which the athletes performed daily before and after training (see table). Not only the phase of the OMC in which the jump test was conducted was taken into account, but also the volume and direction of training effects during this period.

It was found that the height of the vertical jump before training fluctuates on different days of the cycle in athletes from two countries from 38,2 to 45,0 cm, after training – from 35,8 to 43,9 cm. In both cases, the lowest results are shown in the menstrual (I), and the highest - in the postovulatory phase (IV). It is significant that the greatest difference is recorded in the jumps that were performed after training, and the greatest variability of indicators is observed in the menstrual phase. Moreover, the most significant variation is recorded after training, which is associated with both the implementation of training effects of different volume and direction, and with the individual reaction of the athlete's body to them.

Thus, the data of the study indicate the presence of phase changes in the indicators of motor abilities of athletes during the OMC, and the strongest effect of training loads on their motor potential is observed during unfavorable phases of the body's biorhythms.

Conclusions. It can be stated that in their work with the female contingent, coaches do not focus on the OMC, which negatively affects the functional state of athletes and, as a result, their athletic performance. At the same time, the training process organized taking into account the biorhythmological features of the female body will not only ensure higher overall performance, the proper level of special training of athletes, but will also preserve their reproductive health. At the same time, monitoring the individual dynamics of the functional indicators of a specific athlete in various phases of the biological cycle and, in this regard, the individualized focus of the applied training effects, largely optimize strategic approaches in preparation for the main competitions of the season.

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Indicators of vertical jump height (cm) in different phases of the OMC in female athletes

Phases OMC	Before training		After training	
	Runners	Hockey players	Runners	Hockey players
	$\bar{X}$ ±S	$\bar{X}$ ±S	$\bar{X}$ ±S	$\bar{X}$ ±S
I	39,7±2,8	38,2±2,5	36,5±2,7	35,8±2,9
II	43,4±1,1	42,2±1,6	42,8±1,0	41,9±1,8
III	41,1±1,3	40,1±1,7	39,3±1,5	38,7±1,9
IV	45,0±1,2	44,2±1,6	43,9±1,4	43,1±1,6
V	40,3±2,0	40,6±2,1	37,2±2,3	38,3±2,1

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