

Original Article

A method of optimizing the preparation of female wrestlers in the lunar mesocycle

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Abstract:

This article highlights the research material by pedagogical, biochemical, bibliographic methods, as well as methods of mathematical statistics during the process methods of the process of training female wrestlers during the lunar mesocycle. It was established that the lowest level of both anaerobic and aerobic efficiency of female wrestlers was observed in the ovulatory phase of the ovarian menstrual cycle, and during the menstrual phase individual indicators varied widely as their increase and decrease. It was also found that the highest level of general and special physical performance of athletes takes place in the postmenstrual and post-ovulatory phases of the ovarian-menstrual cycle. Biochemical monitoring has established the lowest catecholamine peaks and the highest fatigue (urea) levels during the ovulatory phase, indicating a cause for poor female wrestlers performance. On the basis of these data, a new approach is proposed for the distribution of loads during the monthly mesocycle of female wrestlers. Namely, symmetrically to the phase distribution of the sympatho-adrenal system during the lunar mesocycle: menstrual cycle - 9%, postmenstrual cycle - 26%, ovulatory cycle - 5%, postovulatory cycle - 29%, yellow-body phase - 20%, premenstrual cycle - 11%. It is known that the sympathetic - adrenal system plays a key role in the organization of adaptive changes in the body, both in the pre-start period, forming a state of pre-start combat readiness, and during the overcoming of the muscles of physical activity. (It is this circumstance that forms the basis of the recommendations on the analytical proposal in the distribution of physical activity by volume and intensity during the lunar mesocycle of wrestlers.

Key Words: women's wrestling, improvement, physical capacity, ovarian-menstrual cycle.

Introduction.

The female body has a biological feature that consists in the complex neuro-humoral regulation of ovarian-menstrual function. The cyclical nature of the process is determined by the monthly fluctuations of estrogens and is manifested in the monthly phase of the activity of the reproductive organs. Six phases: menstrual (M), post-menstrual (pM), ovulatory (O), post-ovulatory (pO), yellow-body phase (YBP) and domenstrual(dM), – successively changing each other to form an ovarian-menstrual cycle (OMC) [Pokholenchuk Yu. T. & Svechnikova N. V., 1987, Raiola, G., 2015, L. Shakhlina et al, 2016, Weinberg, R., & Gould, D., 2018].

For the category of women who involved in sports, this information is of particular importance. Thus, according to scientists [Sybil M.G., 1996, BorisPodlivaev, 2015, Budzyn V., O etal, 2018, Budzyn V., O etal, 2019], the neglect of the OMC phases in the distribution of the volume and intensity of the load during the lunar mesocycle creates a problem for 70% of female athletes regarding the realization of their reproductive function. This problem has been exacerbated in recent years. In particular, it touches on such a sporting contingent as women's struggle against the inherent effects of retardation [E. Hübner-Wozniaketal, 2004, HaroldTünnemann, 2013, Ye Tian & Zihong He, 2013, G. Korobeynikov et al, 2019]. Studies of the literature indicate that most coaches of the female contingent of athletes, if they take into account the characteristics of the female body (the presence of phases of the OMC), then mostly their attention is focused on the first phase – menstruation. In this regard, we have set the task of studying the physical performance of female athletes during the OMC. At the sametime, the information about the famous Dutch athlete Blankers-Kuhn, who set 7 out of 9 world records in the menstrual phase of the OMC, is reliable. While the ovulation phase remains out of the attention of coaches. Preliminary studies of the sympatho-adrenalsystem [Sybil M.G., 1996, Y. Svyshchetal, 2018] focus on the

ovulation phase. In particular, biochemical studies of a number of authors [Yuriy, B., et al, 2016, Valeria, T. et al, 2017, Tyshchenko V. et al, 2018, B. Senatore et al, 2019, G. Lisenchuk et al, 2019] established the oscillating nature of the sympathetic-adrenal system in representatives of such sports as basketball, gymnastics, handball, etc., during the phases of the OMC and its influence on their physical performance has been proven. Diagnosis was carried out by testing on a bicycle ergometer (PWC₁₇₀ test) and using the method of calculations in control training. In parallel with the testing of the level of functional readiness of the female athletes, a phase-based biochemical control was performed using the indices of catecholamines (CA) and urea (U). That the sympatho-adrenal system (SAS) plays a leading role in the initiation of energy metabolism processes and the homeostasis function as a whole. And urea has long been used in sports as a universal criterion for fatigue [Pervachuk, R. V., 2013, Sybil M.G. et al, 2015, M. Sybil, et al, 2018].

Material & methods.

Purpose of the study: To study the physical performance of female wrestlers during the lunar mesocycle in order to optimize the physical training process. *Objectives of the study:* 1. To investigate the physical performance of the female wrestlers during the OMC phases according to the technical and tactical indicators of anaerobic (TTP₁) and aerobic (TTP₂) orientation. 2. Investigate the physical performance of the female wrestlers in the individual OMC phases according to the PWC₁₇₀ bicycle ergometric test. 3. Biochemical monitoring of SAS in the phases of WMC of female wrestlers using the fluorescent method of detection of catecholamines (CA), as well as the calorimetric method of detection of urea excretion. 4. To formulate recommendations on correction of volume and intensity of physical activity in monthly mesocycle of female wrestlers. *Methods of research:* 1. Bibliographic method of studying literature sources on the problem and analyzing it with the hypothesis. 2. Pedagogical observation using special control tests and PWC₁₇₀ cycle test. 3. Biochemical monitoring of SAS in the phases of OMC of female wrestlers using the fluorescence method of detection of catecholamines (CA), as well as the calorimetric method of detection of urea excretion. 4. Methods of mathematical statistics. *Organization of the research:* 10 high-qualification female wrestlers (8 masters of sports of Ukraine, 2 masters of sports of Ukraine of international class) participated in the study. Sampling was carried out during the recovery period of the training macrocycle.

Results.

According to the results of pedagogical observations on the measurement of technical and tactical parameters that determine anaerobic and aerobic performance, it was found to be maximum in the female wrestlers in the postmenstrual and post-menstrual phases, with no statistically significant difference between them ($p \geq 0,05$). Conversely, in the ovulation phase, they observed the lowest, significantly different from other phases ($p \leq 0,01$), the level of functional implementation of muscular effort. At the same time, the highest coefficient of variation of the sample was present in the menstrual phase (Fig. 1).

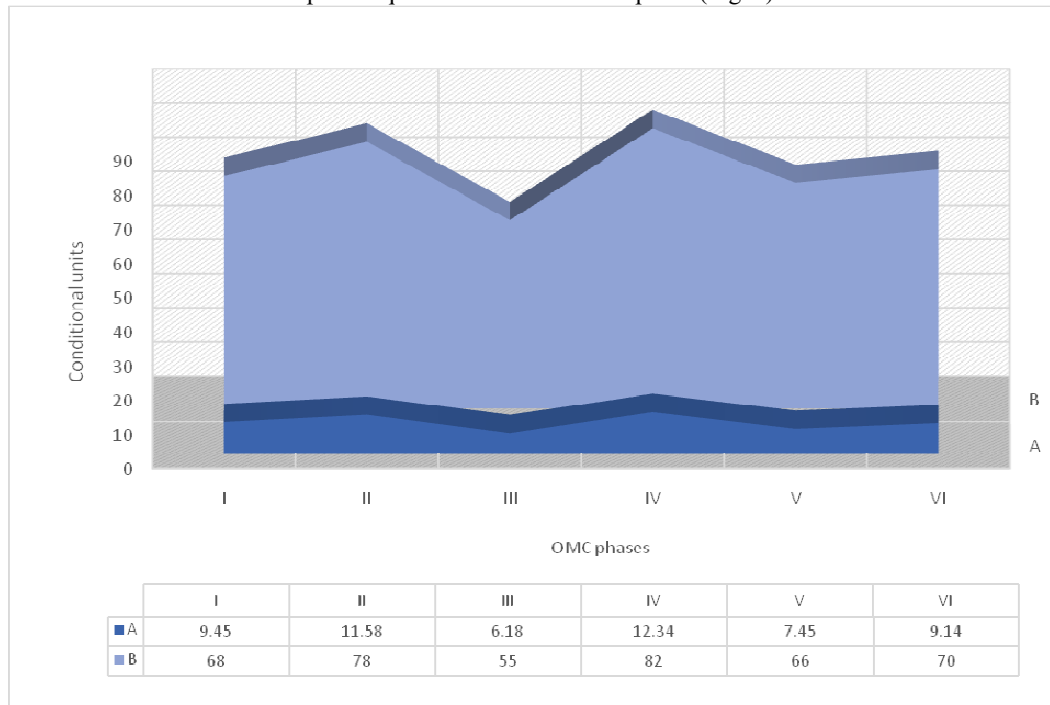


Figure 1. Physical performance indicators of female wrestlers during the OMC phases. A– Techno-tactical indicators 1 (anaerobic), B– Techno-tactical indicators 2 (aerobic).

Similar dynamics of physical performance of the female wrestlers were observed during the OMC phases according to PWC_{170} indicators (Fig. 2), where the highest peaks reached the post-menstrual and post-ovulatory phases, and the lowest were in the ovulation phase.

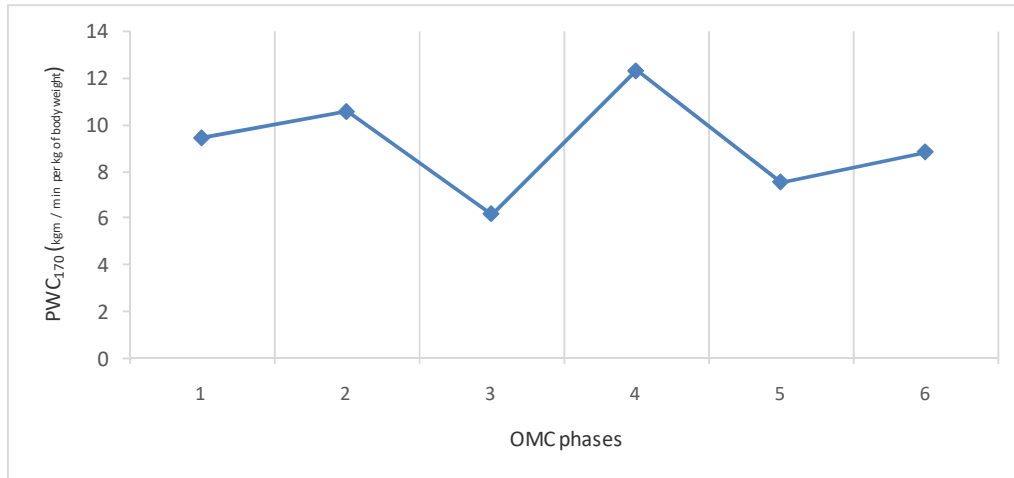


Figure 2. Changes in PWC_{170} performance in female wrestlers by the OMC phases.

The oscillatory nature of the catecholamine components of SAS was also observed (Fig. 3).

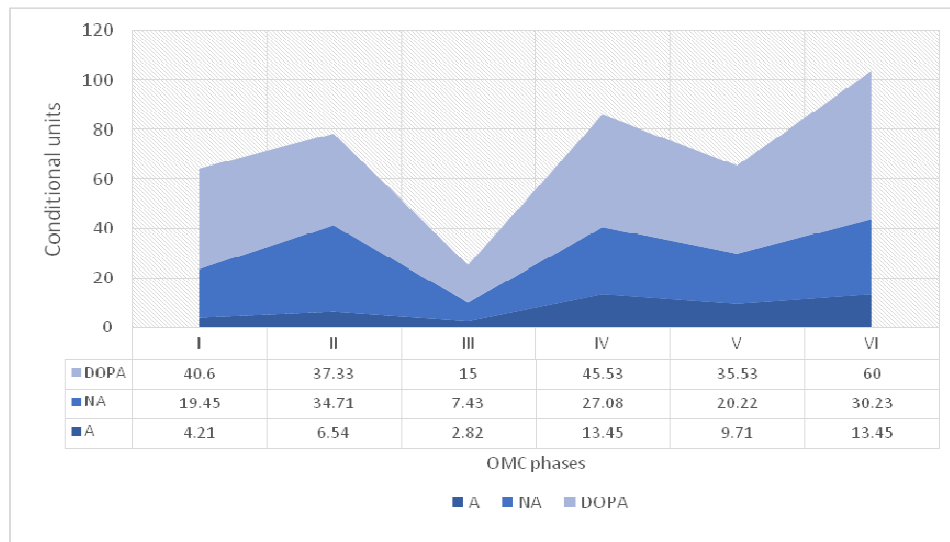


Figure 3. Phase distribution of sympatho-adrenal activity in the monthly mesocycle of female wrestlers(%).

In the ovulation phase, indicators of both the mediator (noradrenaline – NA) and hormonal (adrenaline – A) levels of SAS dramatically decreased their level. The difference between the indicators of both A and NA in the ovulation phase compared with other OMC phases was statistically significant at ($p < 0,01$).

At the same time, the indicator of catecholamine synthesis reserves – DOPA, – reached the maximum level in the ovulatory phase, which will obviously provide the "material" for enhanced CA synthesis in the subsequent OMC phases, providing higher performance than in the ovulatory phase. It is advisable to recall here that catecholamine flow is perceived by the alpha – (for A) and beta – adrenoceptors (for NA) adenylate cyclase complex (ACC) of the cell membrane. The ACC, in turn, initiates energy exchange reactions, which, as a result, leads to increased ATP resynthesis. Thus, if the flow of CA is strong enough (but not too strong!), it provides the body with enhanced energy capabilities, which determines the performance of loads of greater volume and higher intensity.

Obviously, the minimum CA "pressure" on the ACC in the ovulatory phase is sufficient in the sense of providing the main exchange, as well as the probabilities of reproductive function related to this phase. But, probably, such as in the ovulatory phase of the production of CA, it is not enough to organize the energy supply of adaptive reactions to the highest level of physical activity. In sports, such a situation is stated as "lack of

sports form". This state of affairs gave us reason to hypothesize the existence in the body at the cellular level of the protective mechanism of the SAS inhibitory type for the period of ovulation. Observations indicate a synchronous interaction between catecholamines and estrogens on the principle of synergism. In addition, the provision of SAS reactions in the ovulation phase is mediating, that is, norepinephrine, which is inevitably present in the case of endurance. That is, the energy cost of ovulation loading is very high. In this phase, in response to medium intensity loading, maximum urea accumulation, known as fatigue, was observed.

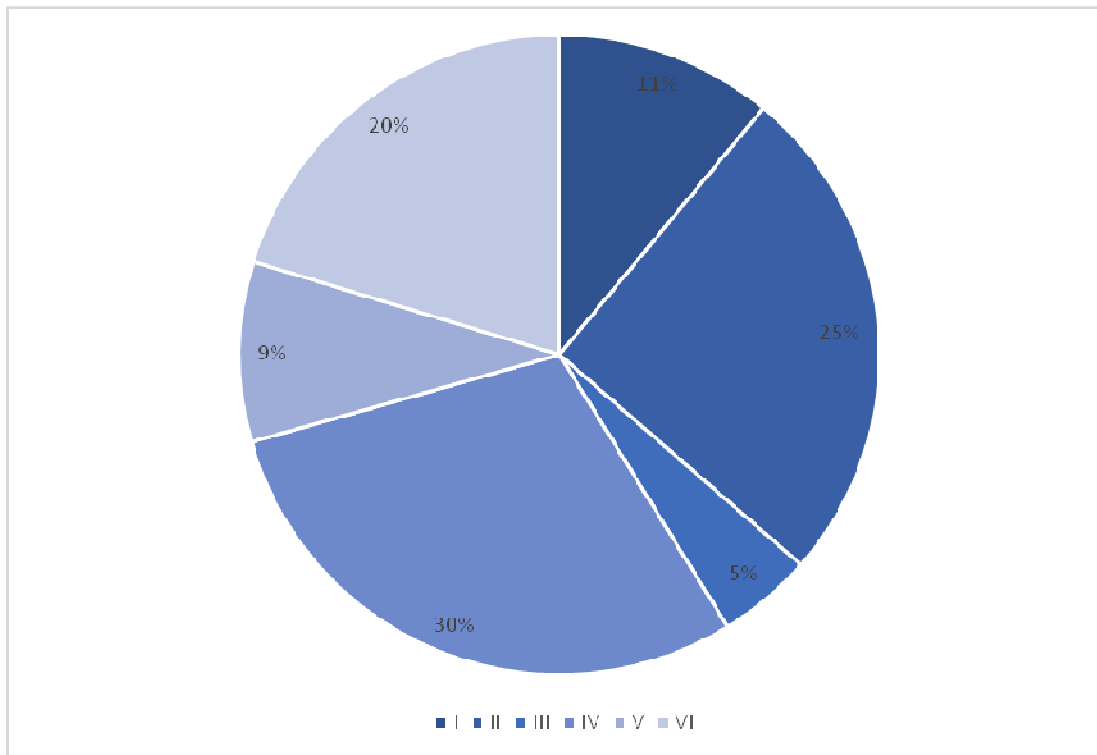


Figure 4. Phase distribution of sympathoadrenal activity in the monthly mesocycle of female wrestlers (%).

Fig.4 shows the percentage distribution of sympatho-adrenal activity during the OMC phases. It can be seen that the minimal activity of SAS was observed in the ovulatory phase, accounting for 5% of total CA production during the lunar cycle. It reached its maximum level in post-menstrual and post-menstrual periods (26% and 29%, respectively).

Dicussion.

The results of pedagogical measurements of anaerobic and aerobic performance of female wrestlers indicate that their high level of skill varies over different phases of the lunar mesocycle. In sports, such conditions qualify as the presence or absence of a sports uniform. Previous biochemical studies [Pokholenchuk Yu. T. &Svechnikova N. V., 1987, Sybil M. G., 1996]of other female athletes (gymnasts, track and field athletes, etc.) for their physical performance against different phases of the lunar cycle have been confirmed by similar changes in female wrestlers. Thus, there was a proposal for correction of physical activity during the lunar mesocycle in accordance with the oscillations of the CA in the OMC phases. Thus, the monthly activity of CA in % by phases was distributed as follows: M – 9%; pM – 26%; O – 5%; pO – 29%;YBP – 20%; dM – 11%. Similarly, this ratio proposes the distribution of physical activity by volumeandintensity during the monthly mesocycle of female wrestlersfrom the sectionofbothgeneralandspecialphysicalcapacity.

Conclusions:

Was identified thatphysical performance of the female wrestlers is different in different stages of the OMC, the lowest level was observed in the ovulatory phase, and the highest in the postmenstrual and post-ovulatory phases.

Was proved thatthe level of SAS activity is a determinant of the degree of hypothetically possible realization of the sports form and is different in different phases of the OMC of female athletes, and in particular female wrestlers. There are useful conclusions aboutthe percentage phase distribution of catecholamine lunar flux can serve as a biomarker of similar volume distribution and intensity of exercise during the lunar mesocycle

of female wrestlers. Also, the practical implementation of our research is the distribution of physical activity and their implementation, which is presented in the discussion section.

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