The dynamics of speed and strength indicators in runners for different distances, depending on the biorhythmics of their body

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Abstract

Objective of the study is to identify the nature of the orientation of training effects depending on the biorhythmological features of the body of qualified female sprinters and middle-distance runners.

Methods and structure of the study. The study involved female track-and-field athletes (n=24) aged 16–18 years specialising in short-distance (n=12) and middle-distance (n=12) running and holding the qualifications of First Sports Category to Candidate for Master of Sport. An analysis was made of the individual duration of the biological cycle, together with a comparison of the data of testing speed and speed-strength abilities in the various phases of the ovarian-menstrual cycle (OMC) over the course of the annual macrocycle of preparation.

Results and conclusions. It was established that the dynamics of the speed-strength indicators of female runners vary substantially depending on the phase of the OMC and on the specialisation of the athletes. Individual differences in the duration of their biological cycle were determined, which conditions the number of days with high working capacity over the course of the annual cycle of preparation. Three types of reaction of the athletes to the phases of the OMC were identified, differing in the degree of decline of working capacity in the unfavourable phases. The need to individualise the training process with account taken of the phases of the OMC and of the specialisation of the runners is demonstrated.

Keywords: *female sprinters and middle-distance runners, OMC, speed-strength abilities, training process, individualisation.*

Introduction. The problem of rationalising sports training, the aim of which is the attainment of a planned level of preparedness within specific time limits, brings to the fore the study of the practical experience of constructing training sessions and the detailed analysis of the dependence of the dynamics of the athlete's state on the volume and orientation of the training load performed [1, 7].

At the same time, the course of the training process of female athletes is particularly influenced by the specific biological cycle, which is accompanied by a whole series of morphological, physiological and psychological changes in their bodies. It is precisely for this reason that an individual approach, ensuring the optimal level of preparedness of the particular athlete with account taken of her biorhythmological features, should constitute an important aspect of the effective planning of the preparation programme of qualified female athletes [1, 3, 6].

In the opinion of a number of researchers, excessive training effects may contribute to overtraining in women to a considerably greater degree than in men [2, 4, 9]. This assumption determines the need to standardise loads that are adequate to the operational and current state of the female body in order to prevent the breakdown of adaptive processes. This fact acquires particular significance in the preparation of female sprinters and middle-distance runners, where high demands are placed both on speed-strength abilities and on special endurance.

Objective of the study is to identify the nature of the orientation of training effects depending on the biorhythmological features of the body of qualified female sprinters and middle-distance runners.

Methods and structure of the study. The study involved female track-and-field athletes aged 16 to 18 years (n=24) specialising in short-distance (100 m, 200 m, n=12) and middle-distance (800 m, 1500 m, n=12) running. The athletes held the qualifications of First Sports Category (15 persons) and Candidate for Master of Sport (9 persons).

On the basis of an analysis of the duration of the athletes' biological cycle and a comparison of the testing data in the various phases of the OMC, the dynamics of their speed-strength indicators were studied. In accordance with the generally accepted classification [8], the OMC was divided into five phases: the menstrual phase, lasting 3–5 days; the postmenstrual phase, 6–9 days; the ovulatory phase, 4 days; the postovulatory phase, 6–9 days; and the premenstrual phase, 3–5 days.

The 30 m run from a flying start was used to determine the level of speed abilities. Speed-strength abilities were assessed by means of the standing long jump and the standing triple jump, as well as throws of a 4 kg shot forwards from below and backwards overhead. The testing was carried out in each of the five phases of the OMC throughout the whole annual cycle of preparation.

Results of the study and discussion. An analysis of the duration of the biological cycle in the female track-and-field athletes examined showed that, depending on this parameter, they may be divided into three groups (Table 1).

It is evident that the shorter the OMC in young female athletes, the smaller the number of days characterised by good and high working capacity. As may be seen from the data presented in the table, the athletes with the longest OMC represent the most effective biological model for the realisation of training plans: on average, they have 228 days with high working capacity per year, which fall within the most 'favourable' phases of the OMC. In runners with a 25–28-day cycle this indicator amounts to 210 days, and in athletes with a 21–24-day cycle to only 192 days. Consequently, when planning the macrocycle it is necessary to take into account not only the phase structure of the OMC but also its overall duration, since the number of days favourable for the performance of high-intensity loads depends on this.

A comparison of the testing data made it possible to identify differences in the dynamics of the speed and speed-strength indicators of runners with different durations of the biological cycle. Although the differences identified did not reach the level of statistical significance ($p>0.05$), a tendency may be traced: athletes with a longer OMC demonstrate a greater gain in speed and speed-strength indicators over the annual macrocycle of preparation. Thus, in runners with a 29–32-day cycle the gain in results in the tests analysed amounted on average to 9.2 %, and in athletes with a 25–28-day cycle to 8.0 %. The athletes with the shortest duration of the cycle increased their indicators by 6.3 %.

Table 1. Distribution of the female runners by the duration of the OMC over the annual macrocycle

Duration of the OMC	Number of athletes	%	Average number of mesocycles per year	Average number of days with high working capacity
21-24 days	6	25.0	16	192
25-28 days	14	58.3	14	210
29-32 days	4	16.7	12	228

Table 2. Distribution of the types of reaction to the phases of the OMC in female runners of different specialisations

Type of reaction	Characteristics	Sprinters	Middle-distance runners
Type I	Sharp deterioration in well-being and working capacity in phases I and V, decline in results in all the tests	6 (50.0 %)	8 (66.7 %)
Type II	Insignificant change in the indicators in phases I and V, preservation of working capacity	4 (33.3 %)	3 (25.0 %)
Type III	High working capacity throughout the whole cycle, minimal fluctuations	2 (16.7 %)	1 (8.3 %)

In the course of comparing the dynamics of the athletes' motor abilities across the phases of the OMC, three types of reaction were distinguished, which were differently distributed among the sprinters and the middle-distance runners (Table 2).

As may be seen from the table, the middle-distance runners proved to be more sensitive to the unfavourable phases of the cycle: 66.7 % of them were assigned to type I, characterised by a sharp deterioration in well-being and working capacity in the menstrual and premenstrual phases. Among the sprinters, the proportion of athletes with a type I reaction amounted to 50.0 %.

The data obtained are consistent with the results of the research of a number of authors [1, 3, 5, 8, 9, 10], showing that the dynamics of the motor capabilities of female athletes over the course of the OMC are wave-like in character. Our observations also confirm that in the menstrual and premenstrual phases the level of the speed and speed-strength abilities of female runners is minimal, whereas in the postmenstrual and postovulatory phases it is at its highest.

The more pronounced deterioration of the indicators in middle-distance runners may be connected with a number of factors. Thus, the specific nature of their preparation implies a greater total volume of training loads, which leads to the accumulation of fatigue. Alongside this, the dominant orientation of the training process of middle-distance runners places increased demands on the aerobic systems of energy supply, which are distinguished by an increased sensitivity to hormonal fluctuations.

The earlier data of our research, conducted on high-class female runners, showed [1, 5] that speed abilities are manifested to a greater degree in the postovulatory phase and that the improvement of the result in the 30 m run from a flying start occurs through an increase in the frequency of the running strides. As regards speed endurance, the dynamics of the speed indicators in the 150 m run at the stages of the annual cycle and in the various phases of the OMC indicate the predominant manifestation of this ability in the postmenstrual phase. The improvement of the result here is connected with the capacity to produce a greater length of running stride and to maintain it optimally to the end of the distance.

At the same time, account should be taken of the fact that a characteristic feature of one or another duration of the OMC is the differing duration of the first half of the cycle (up to ovulation) and the identical duration of the second half (from ovulation to menstruation) [8, 10, 11]. Thus, the longer the athlete's OMC, the greater the preconditions for realising the programme of developing special endurance. At the same time, in athletes with a short duration of the OMC the tasks of increasing speed endurance have to be realised in a phase that is not the most favourable for this. In addition, this creates difficulties in the interrelations of the development of particular motor abilities (for example, maximum speed and speed endurance).

Thus, in the postovulatory phase fewer conditions are created for raising the level of speed endurance, and its purposeful development is better carried out in the postmenstrual phase. As regards speed capabilities, it is preferable to improve them in the postovulatory phase of the OMC. This must be taken into account when planning the training process, focusing attention on the individual features of the manifestation of one or another motor ability in the most favourable phase of the specific female cycle.

Conclusions. It was established that the dynamics of the speed and speed-strength indicators of female sprinters and middle-distance runners vary substantially depending both on one or another phase of the OMC and, in general, on the individual duration of the cycle itself, which determines the number of days with high working capacity per year.

Three types of reaction of the athletes to the phases of the OMC were identified, differing in the degree of decline of working capacity in the unfavourable phases. Middle-distance runners belong more often to the first type, characterised by a sharp deterioration in well-being and a decline in results in the menstrual and premenstrual phases, in comparison with sprinters. At the same time, in the postovulatory phase of the OMC it is better to place the emphasis in the training effects on raising the speed and speed-strength indicators, and in the postmenstrual phase to perform work connected with the development of special endurance.

Thus, the coach faces the task not only of taking into account the volume and orientation of the training load in the various phases of the OMC, but also of knowing its individual duration in one or another of his athletes, which will make it possible to determine the so-called 'favourable' and 'unfavourable' periods for the performance of large specific motor loads of a particular orientation.

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