

Features of phase changes of some morphofunctional indices in girls during ovarian-menstrual cycle

BUDZYN VIRIA¹, OLHA MATVIYAS², IHOR LAPYCHAK³, NATALIA BAZYLYAK⁴, NATALYA ZHARSKA⁵

^{1,2,3,4,5}Lviv State University of Physical Culture, Lviv, UKRAINE

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Abstract. The problem of dynamics of changes in the main morphological and functional indices during the ovarian - menstrual cycle in girls aged 18-20, who deal with football, and “non-sporting” girls of the same age, was studied. Cyclic hormonal changes in the female body, affecting the functional state of the motor apparatus, may be accompanied by changes in certain morphological parameters of female athletes. The data obtained allowed to establish the presence of certain cyclic changes in the main morphological and functional indicators and their calculation indices. The largest digital values of height, mass, and body surface of the girls in both groups were established in the I and II phases of the biological cycle due to the delayed water in the body in the specified phases because of hormonal changes. To a certain extent, this conclusion is confirmed by the highest values of the Kettle's weight index in certain (I and V) phases. At the same time, in the middle of the cycle (phase III), there is a tendency to decrease the mass and body surface.

Key words: soccer players, ovarian-menstrual cycle, phases, girls, morphological and functional indices, cycle.

Introduction.

Sports and sports activities are integral components of the social, economic and cultural life of modern society. Today, no one has doubts about the regularity and the need to participate in women' sports activities, although, in the historical perspective, this phenomenon is significantly "younger" than men's sports competitions.

Widespread involvement of women in sporting activities, the increase of their importance in sports, and the understanding of sport as a means of displaying the women' individuality, leads to the search for ways to enhance their athletic skills, and, consequently, sports achievements (Radzyevskiy, 1990). A characteristic feature of the modern stage in the development of women's sports is gaining proficiency by women in those sports that are considered men's ones: football, weightlifting, boxing, etc. A sports game, namely football, requires a comprehensive training of players, since it requires the implementation of dynamic variable-intensity work with uneven load during play. At the same time, the persistent work of athletes and coaches is sometimes offset by ignorance or neglect of a female body's activity laws which, unlike the male ones, function cyclically (Budzyn, 2018).

Analysis of recent publications.

Physical qualities, in particular morphological status, to a large extent determine the professional capabilities of athletes. However, the state of the muscles and the associated ability of women - athletes undergo certain cyclic changes: hormonal fluctuations are accompanied by an organism redistribution of water, a violation of the electrolyte balance and excitability of the peripheral nervous system, activation of the multi-directional areas of the autonomic nervous system, etc. In particular, it was found that in the postmenstrual and postovulatory phases of the biological cycle the muscle strength is significantly increased (Pokholenchuk, 1987), whereas during the ovulatory phase the muscle strength of the hand is less than that of the postmenstrual and postovulatory phase, but greater than in the premenstrual and menstrual phases (Budzyn, 2018, Barabasz, 2009). The indicated oscillations of the muscle are associated with the metabolic effect of estrogens, the concentration of which in the blood of women significantly increases during the postmenstrual and postovulatory phases of the ovarian-menstrual cycle (further OMC) (Dulida, 2000). Increased mobility in the joints of athletes, which is observed during the menstrual phase of the cycle, occurs due to an increase of the connective tissues elasticity, but this does not always have a positive effect on the shock absorption in the spine area and large joints (Radzyevskiy, 1990). In connection with the overstimulation of the nervous system during the menstrual phase, pain may occur in the joints and muscles, besides pain in the abdomen may lead to temporary posture disorders (Radzyevskiy, 1990).

Thus, the female body' cyclic hormonal changes affecting the functional state of the musculoskeletal system, may be accompanied by changes in certain morphological parameters of female athletes. Studies done

by Duliba O. B. (Duliba, 2000) show that during the biological cycle such morphological and functional characteristics of the body as height, weight and body surface undergo some changes in girls-gymnasts' body. At the same time, in the available literature resources, we did not find information on these parameters changes for girls who are engaged in such a popular and promising sport as soccer.

The aim of the study is to determine the presence of the changes in the main morphological and functional indices during the OMC in women - football players.

Objectives of the study.

1. To find out the peculiarities of cyclical changes in the studied morphological and functional indices in girls - football players aged 18-20.
2. To find out the peculiarities of cyclical changes in the studied morphological and functional indices in girls of the same age who are not engaged in sports.
3. To compare the results.

Organization of research. The study involved 50 girls aged 18-20, which were divided into 2 groups: basic group and comparative one. The basic group included girls who studied at the Lviv State University of Physical Culture at the specialty "Football" and are trained according to the curriculum for this sport. The comparative group consisted of "non-sporting" girls who studied at the same university at the specialty "physical rehabilitation" and were not engaged into significant physical activity. The examination was done at the beginning of the academic year (September-October). The obtained results were processed by the method of mathematical statistics with the definition of X, σ , m and compared according to Student's t-criterion.

Discussion.

The informative integral parameters of an organism's morphological and functional state (height and weight of the body) and their calculated indices (body surface, height and weight indices of Kettle and Broca-Brugsch) were investigated.

The body mass was determined using a medical scales (determination error ± 0.05 kg), the height - using an auxanometer (scale division value is 0.5 cm). The weight - height index of Kettle was determined by the formula:

$$P = W / L, \text{ where}$$

P is the value of the Kettle index (g / cm)

L - height (cm)

W - mass (g)

Normally, women with 1 cm of height account for 325 -375 g of mass; an increase in the digital values of the index in athletes indicates well-developed muscles, in non-athletes it tells about increased amount of subcutaneous fat tissue [].

Broca-Brugsch weight - height index was determined by the formula:

$$P = L-100 \text{ height of the examined individuals within } 150-165 \text{ cm.}$$

$$P = L-105 \text{ height of the examined individuals within } 166-175\text{cm, where}$$

P - Broca-Brugsch index value (kg), L-height (cm).

The index allows us to determine the proper weight of the body of the examined individuals in relation to their height.

The body surface was determined according to the Isaacson formula:

$$S = (100 + W + (H-160)) / 100, \text{ where}$$

S - body surface (m²),

W - body weight (kg),

H - height (cm).

The results of the definition of morphological and functional indices and calculation indices in the various phases of the biological cycle in the students - girls who played football are presented in Table 1.

Table 1.

Morphological and functional indices and calculation indices for girls aged 18-20 who play football (n = 30).

Indices	OMC phases				
	I X \pm m	II X \pm m	III X \pm m	IV X \pm m	V X \pm m
Height (cm)	163.10 \pm 7.20	163.10 \pm 7.20	163.10 \pm 7.20	163.90 \pm 7.25	164.08 \pm 7.23
Weight (kg)	55.33 \pm 7.39	54.23 \pm 7.20	53.45 \pm 7.07	54.03 \pm 7.10	54.92 \pm 7.05
Kettle's index (g/cm)	336.94 \pm 36.20	332.21 \pm 36.19	326.83 \pm 35.98	312.49 \pm 76.09	334.22 \pm 35.33
Broca-Brugsch index (kg)	61.61 \pm 4.74	61.60 \pm 4.74	61.77 \pm 4.88	62.07 \pm 4.30	62.25 \pm 4.31
Body surface (m ²)	1.59 \pm 0.13	1.57 \pm 0.13	1.54 \pm 0.24	1.58 \pm 0.13	1.59 \pm 0.13

Note. Here and then the value of p> 0.05 was not shown in the table.

As the research showed, the highest body mass index in girls-football players was observed at the I and V phases of OMC (respectively 55.33 ± 7.39 and 54.92 ± 7.05 kg), the lowest one in the III phase (53.45 ± 7.07 kg).

The highest values of the Kettle's weight-height index were observed at the I, II and V phases of the biological cycle (336.94 ± 36.20 , 332.21 ± 36.19 and 334.22 ± 35.33 g / cm, respectively), the lowest at the IV phase (312.49 ± 76.09 g/cm). The obtained data testify that the development of girls-football players' musculature is on the low limit of norm.

Indices of the body surface also revealed a natural dynamics: the highest values were observed at the I and V phases of the OMC (1.59 ± 0.13 and 1.59 ± 0.13 m² respectively), the lowest ones at the III phase (1.54 ± 0.24 m²), and all differences were statistically doubtful.

The dynamics of other studied indices was not significant. In particular, the height index did not reveal natural dynamics - it ranged from 164.08 ± 7.23 cm at the V phase to 163.10 ± 7.20 cm at the I, II, and III phases, and 163.90 ± 7.25 cm at the IV phase. According to the results of determining the Broca-Brughsh weight-height index, the weight of the body of the surveyed girls -footballers was appropriate for their height; the differences between the results obtained at the I-III and IV-V phases were minimal: 61.61 ± 4.74 kg - 61.61 ± 4.88 kg vs 62.07 ± 4.30 - 62.25 ± 4.31 kg.

The results of determining the morphological and functional indices and calculation indices at different phases of OMC among the students of the comparison group are presented in the Table 2.

Table 2.

Morphological and functional indices and calculation indices for girls aged 18-20 who are not engaged in sports (n = 20).

Indices	OMC phases				
	I X±m	II X±m	III X±m	IV X±m	V X±m
Height (cm)	164.70±5.09	164.70±5.09	164.75±5.08	165.53±5.14	165.78±5.11
Weight (kg)	55.93±6.23	55.61±5.95	54.20±6.14	54.83±6.08	55.60±6.11
Kettle's index (g/cm)	332.39±37.66	339.53±25.96	328.62±32.40	330.88±31.90	336.86±31.57
Broca-Brughsh index (kg)	62.45±3.76	62.45±3.76	62.50±3.78	62.75±3.77	62.78±3.66
Body surface (m ²)	1.61±0.10	1.60±0.10	1.59±0.10	1.61±0.10	1.62±0.10

As it can be seen from the study results, the highest body weight indices observed in the examined girls of the comparison group were revealed at the I and V phases (55.93 ± 6.23 and 55.60 ± 6.11 kg, respectively), the lowest at the III phase (54.2 ± 6.14 kg).

The highest values of the Kettle's weight index at the I and V phases of the biological cycle were (332.39 ± 37.66 and 336.86 ± 31.57 g/cm, respectively). At the same time, the results are at the low limit of the norm, which may indicate insufficient development of the muscles in the examined girls. The body surface indices revealed natural dynamics: its highest values were at the V, III and I phases (1.62 ± 0.10 , 1.61 ± 0.10 and 1.61 ± 0.10 m², respectively), the lowest ones - at the third phase (1.59 ± 0.10 m²), however, all differences were statistically doubtful.

The phase dynamics of the other studied indices was as follows: the height ranged from 164.70 ± 5.09 – 164.75 ± 5.08 cm at the I, II and III phases to 165.53 ± 5.14 – 165.78 ± 5.11 cm at the IV and V phases ($p > 0.5$), the Broca-Brughsh weight-height index at all phases of the OMC varied in a small range (from 62.45 ± 3.76 kg at the I and II phases to 62.78 ± 3.66 kg at the V phase; $p > 0.5$).

Comparison results of the studied indices of the morphological and functional status of girls playing football, and "non-sporting" girls of the same age, are presented in Table 3.

Table 3

Morphological and functional indices and calculation indices for girls aged 18-20 playing football and "non-sporting" girls of the same age, (n = 50)

Indices	OMC phases				
	I X±m	II X±m	III X±m	IV X±m	V X±m
Height (cm)	a.163.10±7.20 6.164.70±5.09	a.163.10±7.20 6.164.70±5.09	a.163.10±7.20 6.164.75±5.08	a.163.90±7.25 6.165.53±5.14	a.164.08±7.23 6.165.78±5.11
Weight (kg)	a.55.33±7.39 6.55.93±6.23	a.54.23±7.20 6.55.61±5.95	a.53.45±7.07 6.54.20±6.14	a.54.03±7.10 6.54.83±6.08	a.54.92±7.05 6.55.60±6.11
Kettle's index (g/cm)	a.336.94±36.20 6.332.39±37.66	a.332.21±36.19 6.339.53±25.96	a.326.83±35.98 6.328.62±32.40	a.312.49±76.09 6.330.88±31.90	a.334.22±35.33 6.336.86±31.57
Broca-Brughsh index (kg)	a.61.61±4.74 6.62.45±3.76	a.61.60±4.74 6.62.45±4.5	a.61.77±4.88 6.62.50±3.78	a.62.07±4.30 6.62.75±3.77	a.62.25±4.31 6.62.78±3.66
Body surface (m ²)	a.1.59±0.13 6.1.61±0.10	a.1.57±0.13 6.1.60±0.10	a.1.54±0.24 6.1.59±0.10	a.1.58±0.13 6.1.61±0.10	a.1.59±0.13 6.1.62±0.10

Note: a) girls playing football; b) "non-sporting" girls.

The analysis of the obtained results showed that the numerical values of the studied indices in the both groups were practically the same (differences were $\pm 1\sigma$), that might indicate the coincidence of the nature of the phase changes of these indices among the girls of the main and comparison groups.

Conclusions.

The conducted study allowed establishing the presence of certain cyclical changes in the main morphological and functional indices and the calculation indices for girls aged 18-20. The highest numerical values of height, mass, and body surface of girls in both groups were established at the I and II phases of the biological cycle due to the water kept in the body at the indicated phases because of hormonal reorganization (Barabasz, 2000). To a certain extent, this conclusion is also confirmed by the highest values of the Kettle's weight index at the phases discussed (I and V). At the same time, in the middle of the cycle (III phase) there is a tendency to the decrease of a body's mass and surface.

Thus, the highest values of the studied indices were recorded at the I, IV, V phases, with the highest one (maximum) at the V phase; the reduction of the numerical values of the studied morphological and functional indices is characteristic for the II and III phases. Considering that water retention in the body is accompanied by the swelling of connective tissue elements, in particular, collagen and elastic fibers, which limits the range of joints motion, we have established that some cyclical changes in morphological and functional indices with a certain percentage of probability can affect the sporting results of girls-football players.

Further related investigations. Since the function of the cardiovascular system of girls playing football is insufficiently investigated, in order to improve their training and competitive activities, it is expedient to study the changes of central hemodynamics and cardiovascular reactions on the load at the various phases of OMC in girls - female football players.

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