

Influence of bodybuilding training on changes in the anthropometric indicators of skilled female athletes in different phases of a specific biological cycle

Yevheniia Dzhym

Kharkiv State Academy of Physical Culture, Kharkiv, Ukraine

Purpose: to carry out research on the influence of the activities of female athletes engaged in bodybuilding on changes in anthropometric indicators in different phases of the ovarian-menstrual cycle (OMC).

Material & Methods: studies were conducted in the fitness clubs of Kharkiv "Pheromone", "City", "King" with qualified athletes who are engaged in bodybuilding for 3 months of the preparatory period in the amount of 22 people. As research methods used: analysis of literature sources and testing of the level of motor qualities in individual phases of the OMC.

Result: presented analysis of the condition of the female athletes taking into account the features of the OMC phases and the testing of body weight and anthropometric indicators in different phases of a specific biological cycle in qualified female athletes engaged in bodybuilding.

Conclusion: Obtained results indicate that the anthropometric indicators of qualified female athletes engaged in bodybuilding are not the same in the phases of the ovarian-menstrual cycle. It was revealed that during the OMC period the body is able to retain water, which leads to fluctuations in the body weight of female athletes from 0,5 to 2,5 kg, while on the 3rd–6th day and on the 25–26th there is an increase in body weight, and on the 7th and 16th – its decrease. According to the results of the study, in the first phase, the decrease in anthropometry and body weight, this is due to the rejection of the mucous membrane of the uterus and menstrual bleeding.

Keywords: testing, OMC phases, body weight, anthropometric indicators, bodybuilding, female athletes.

Introduction

One of the most significant differences of the female body from the male is the structure and functioning of the reproductive system and its hormonal regulation [6; 16]. Therefore, the recommendations of any health systems should be based on taking into account the characteristics of their effects on women in different phases of the ovarian-menstrual cycle. First of all, it should be borne in mind that these changes during the cycle occur not only in the female's reproductive system but extend to a number of other systems and organs (nervous, cardiovascular, endocrine, respiratory, immune, etc.) [18; 19; 20].

There are two main points of view on the relationship between the ovulatory-menstrual cycle and performance. Some experts deny the dependence of performance on the phases of OMC in female athletes [2]. Other scientists [1, 4, 17] believe that the different concentration of sex hormones in the body during the ovulatory-menstrual cycle, changes the functional state of the vital systems of the body, can not but be reflected in the level of efficiency of female athletes. Meanwhile, it is proved that not in all phases of the biological cycle female athletes are able to perform training and competitive loads.

For example, Ukrainian researchers [5, 12; 14; 16; 17], dealing with the problem of women's sports for many years, came to the conclusion that in all women the level of manifestation of different motor abilities during the ovulatory-menstrual cycle does not remain constant and varies in accordance with the phases of the cycle.

At the same time, the researchers, not denying the influence of the menstrual function on the ability to work, pay attention

to the individuality of its dynamics in separate phases in different female athletes [11; 15].

Researchers who studied the muscular activity of women, found that, depending on the nature of the course of the ovarian-menstrual cycle and the dynamics of performance of all athletes can be divided into categories. Thus allocate such group of women at which stability of working capacity during an ovarian-menstrual cycle is observed, and group of sports-women in whom there is a sharp decrease in working capacity in a menstrual phase. Other groups identified by scientists are different: these are the female athletes who have reached the menstrual phase of maximum performance, and female athletes who show the highest level of performance during ovulation [17].

In the work of L. G. Shakhlina, the classifications of women according to the results of subjective self-evaluation of health in the menstrual phase are presented [17]:

1 group – female athletes with a good state of health and good objective condition. Sports results are independent of the phases of the ovarian-menstrual cycle.

2 group – female athletes, complain of drowsiness, weakness, reluctance to exercise; they usually have low blood pressure.

3 group – female athletes who have headaches such as migraines, pain in the lower abdomen and in the lower back, increased arterial blood pressure in them is often increased, and the pulse is increased.

4 group – female athletes, who have symptoms of poisoning: loss of appetite, nausea, joint pain, aching, restless sleep,

sometimes increased heart rate, breathing, lowering blood pressure, fever.

G. Erdeby study shown that in those sports where female athletes receive high physical loads (ski races, different kinds of rowing), they have deep violations of menstrual function (amenorrhea, hypomenorrhea, dysmenorrhea, etc.). Moreover, the author notes that during the period of reduction of both physical and mental load in their normalization observed occurrence of ovarian-menstrual cycle [18]. Negative effect of intensive physical exertion on the course of this cycle in female athletes is reported in a number of works [3; 7; 8; 9; 10; 13].

Studying the question of changes in other systems of the female athlete's body in connection with the comparison of the different phases of their menstrual cycle, the authors determined, firstly, their presence, and secondly, the dependence of the depth of functional metabolic changes in organs and tissues from the phase of the ovarian-menstrual cycle.

There are studies whose authors are sure that female athletes can continue training and compete during the entire ovarian-menstrual cycle [9]. At the same time, authors who hold such an opinion, note that with the participation of female athletes in competitions in the premenstrual and menstrual phases of their ovarian-menstrual cycle, the results and achievements deteriorate substantially.

Above analysis of the literature data shows that the majority of authors dealing with this problem express unanimous opinion about the high level of manifestation of the basic physical qualities (except flexibility) in the postmenstrual and postovulatory phases and about the decrease in menstruation, ovulation and premenstrual period. However, the question of the minimum level of manifestation of a specific motor quality during the ovarian-menstrual cycle remains open. Also conducted studies in various sports do not fully reflect the specifics of sports activities of a force character, which includes bodybuilding, which requires the conduct of research.

Relationship of research with scientific programs, plans, themes. The scientific research was carried out on the theme of the Consolidated Plan of Research Work in the Sphere of Physical Culture and Sport for 2011–2015. On topic 3.7 "Methodological and organizational-methodological basis for determining the individual rate of a person's physical condition" (state registration number 0111U000192).

Purpose of the study: to carry out research on the influence of the activities of female athletes engaged in bodybuilding on

changes in anthropometric indicators in different phases of the ovarian-menstrual cycle.

Material and Methods of the research

Research was carried out in sports fitness clubs of the city of Kharkov "Pheromone", "City", "King" with skilled female athletes engaged in bodybuilding, for 3 months of the preparatory period in the number of 22 people. As research methods used: analysis of literature sources and testing of the level of motor qualities in individual phases of the OMC.

Results of the research and their discussion

When planning the training process of female athletes engaged in bodybuilding, it is important to distribute anthropometric indicators taking into account the performance in different phases of the OMC. Therefore, we conducted studies during 3 mesocycles of the preparatory period with the determination of the influence of individual phases of OMC on the manifestation of changes in anthropometric indicators, the results of which are presented in Table 1.

As evidenced by the results, the highest changes in anthropometric indicators were obtained in the premenstrual phase, since the fertilization of the egg did not occur; the yellow body degenerates 2–3 days before the onset of menstruation. Concentration in the blood of progesterone and estrogen decreases, reducing the body's functionality.

During OMC observed pronounced hormonal changes in blood composition, strength performance, muscle tone, water-electrolyte metabolism. Ability of the body to retain water also changes, which leads to fluctuations in the body weight of athletes from 0,5 to 2,5 kg, while on the 3–6th day and on the 25–26th there is an increase in body weight, and by 7 and 16th – its decrease. As the results indicate, in the first phase, the decrease in anthropometry and body weight, this is due to the rejection of the mucous membrane of the uterus and menstrual bleeding. During this period there is a sharp drop in the level of metabolism, including the exchange of proteins. In the cerebral cortex disturbs the processes of attention. The sensitivity of the visual, tactile and other sensory systems decreases. Increased irritability, emotional imbalance. Slows respiration rate and heartbeat. In connection with the loss of blood (usually 150–200 ml), the number of erythrocytes, hemoglobin, leukocytes and platelets decreases. Thus, in the second phase, the follicle develops in the ovary until it ripens and ruptures (this phase is also called follicular or pre-ovulatory). During this period, the content of the female sex hormone

Table 1

Dynamics of anthropometric indicators in different phases of the ovarian-menstrual cycle in skilled athletes engaged in bodybuilding (n=22)

Indicators	Phase OMC				
	I	II	III	IV	V
Body weight, kg	63,5±1,21	61,5±1,10	62,7±1,12	63,6±1,51	65,5±1,09
Circumference of chest (inhalation), cm	93,2±0,77	91,4±0,97	93,0±0,92	94,3±0,80	97,5±0,93
Circumference of chest (exhalation), cm	88,4±0,82	86,7±0,95	88,9±0,98	89,5±0,88	92,8±0,95
Circumference of the shoulder, cm	33,4±0,68	32,8±0,67	33,6±0,60	34,6±0,72	35,7±0,77
Waist circumference, cm	72,1±0,59	70,2±0,60	71,0±0,65	71,2±0,75	73,7±0,53
Thigh circumference, cm	51,3±0,68	49,1±0,55	50,0±0,47	50,3±0,56	54,2±0,64
Shin circumference, cm	34,3±0,48	33,5±0,47	34,6±0,40	35,6±0,52	36,9±0,57

Note. Phase OMC: I – menstrual; II – postmenstrual; III – ovulatory; IV – postovulatory; V – premenstrual.

Table 2

Matrix of reliability of the difference in the body weight in different phases of the OMC in skilled female athletes engaged in bodybuilding (n=22)

Phase OMC	II	III	IV	V
I	t=1,22; >0,05	t=0,49; >0,05	t=0,05; >0,05	t=1,23; >0,05
II		t=0,76; >0,05	t=1,12; >0,05	t=2,58; <0,05
III			t=0,48; >0,05	t=1,79; >0,05
IV				t=1,02; >0,05
V				

estrogen in the blood increases, and the development of the mucous uterus. The body weight in this phase can decrease by 2 kg, and in the third phase, the egg follicle (ovulation) exits and falls into the fallopian tubes and further into the uterus. In phase IV, the follicle remains a yellow body, which becomes a new gland of internal secretion and begins to release the hormone progesterone, in this regard; this phase is considered the most workable.

Thus, the highest body weight indices are shown (Table 2) by female athletes in the V and II phases in relation to other phases of the OMC.

At the same time, the indices in the body weight in the V phase are significantly ($p < 0.05$) higher in comparison with other phases of the OMC.

It should be noted about the high rates of female athletes in the chest circumference on the inspiration and the chest circum-

Table 3

Matrix of reliability of the difference in the circumference of chest (inhalation) and circumference of chest (exhalation) in different phases of the OMC in skilled female athletes engaged in bodybuilding (n=22)

Phase OMC	II	III	IV	V
I	t=1,45; >0,05	t=0,17; >0,05	t=0,99; >0,05	t=3,56; <0,001
II		t=0,39; >0,05	t=0,91; >0,05	t=3,44; <0,001
III		t=1,20; >0,05	t=2,31; <0,05	t=4,54; <0,001
IV		t=1,61; >0,05	t=2,16; <0,05	t=4,47; <0,001
V			t=1,07; >0,05	t=3,44; <0,01
			t=0,46; >0,05	t=2,81; <0,05
				t=2,61; <0,05
				t=2,51; <0,05

Note. Top line – chest circumference (inspiration); bottom line – chest circumference (exhalation).

ference on exhalation (Table 3). Thus, the lowest of them are shown in post-menstrual ($91,4 \pm 0,97$ cm and $86,7 \pm 0,95$ cm) and ovulatory ($93,0 \pm 0,92$ cm and $89,5 \pm 0,88$ cm), which reliably lower results in the II and IV phases of the OMC ($p < 0,001$).

Changes in the circumference of the shoulder and waist circumference (Table 4) have significantly higher ($p < 0,001$) results in the V and I phases of the OMC, which fully coincides

Table 4

Matrix of reliability of the difference in the circumference of the shoulder and waist circumference in different phases of the OMC in skilled female athletes engaged in bodybuilding (n=22)

Phase OMC	II	III	IV	V
I	t=0,63; >0,05	t=0,22; >0,05	t=1,21; >0,05	t=2,24; <0,05
II		t=1,25; >0,05	t=0,94; >0,05	t=2,02; <0,05
III		t=0,89; >0,05	t=1,83; >0,05	t=2,84; <0,01
IV		t=0,90; >0,05	t=1,04; >0,05	t=4,37; <0,001
V			t=1,07; >0,05	t=2,15; <0,05
			t=0,20; >0,05	t=3,22; <0,05
				t=1,04; >0,05
				t=2,72; <0,05

Note. Top line – circumference of the shoulder; bottom line – waist circumference.

Table 5

Matrix of reliability of the difference in the thigh circumference and shin circumference in different phases of the OMC in skilled female athletes engaged in bodybuilding (n=22)

Phase OMC	II	III	IV	V
I	t=2,52; <0,05	t=1,57; >0,05	t=1,14; >0,05	t=3,11; <0,01
II		t=1,19; >0,05	t=0,48; >0,05	t=3,49; <0,01
III		t=1,24; >0,05	t=1,53; >0,05	t=6,04; <0,001
IV		t=1,78; >0,05	t=3,00; <0,01	t=4,60; <0,001
V			t=1,52; >0,05	t=5,29; <0,001
			t=0,20; >0,05	t=3,30; <0,01
				t=4,59; <0,001
				t=1,68; >0,05

Note. Top line – thigh circumference; bottom line – shin circumference.

with the results in the measurements given earlier in Table 1. It should be noted that the indicators of female athletes in the thigh circumference (Table 5) have significantly higher ($p < 0,001$) results in the V phase of the OMC ($54,2 \pm 0,64$ cm). Indicators of female athletes in the shin circumference had no significant difference ($p > 0,05$) in the phases OMC ($36,9 \pm 0,57$ cm).

Conclusions

Results show that the anthropometric indicators of skilled athletes engaged in bodybuilding are not the same in the phases of the ovarian-menstrual cycle. It was revealed that during the

OMC period the body is able to retain water, which leads to fluctuations in the body weight of athletes from 0,5 to 2,5 kg, while on the 3–6th day and on the 25–26th there is an increase in body weight, and on the 7th and 16th – its decrease. As the results indicate, in the first phase, the decrease in anthropometry and body weight, this is due to the rejection of the mucous membrane of the uterus and menstrual bleeding.

Prospects for further research provide for determining the influence of bodybuilding training on the functional state and psychophysical characteristics of female athletes in different phases of the ovarian-menstrual cycle.

Conflict of interests. The author declares that no conflict of interest.

Financing sources. This article didn't get the financial support from the state, public or commercial organization.

References

- Dibner, R.D. (1998), *Meditsinskie aspekty adaptatsii v zhenskom sporte* [Medical aspects of adaptation in women's sports], SPbGAFK, SPb. (in Russ.)
- Yekhlakova, Ye.F. (1958), *Vliyanie menstrualnogo tsikla na sportivnyuyu rabotosposobnost lyzhnits: avtoref. diss. na soiskanie uch. stepeni kand. ped. nauk: spets. 13.00.04 «Teoriya i metodika fizicheskogo vospitaniya, sportivnoy trenirovki, ozdorovitelnoy i adaptivnoy fizicheskoy kultury»* [The influence of the menstrual cycle on the athletic performance of skiers: PhD thesis abstract], Leningrad, 20 p. (in Russ.)
- Iordanskaya, F.A. (2012), *Muzhchina i zhenshchina v sporte vysshikh dostizheniy: Problemy polovogo dimorfizma* [Man and woman in the sport of higher achievements: Problems of sexual dimorphism], Sov. sport, Moscow. (in Russ.)
- Klimenko, A.V. (2002), *Organizatsionno-metodicheskoe obespechenie fizicheskogo vospitaniya studentok s uchetom ovarialno-menstrualnogo tsikla: avtoref. diss. na soiskanie uch. stepeni kand. nauk po fiz. vosp. i sportu: spets. 24.00.02 «Fizicheskaya kultura, fizicheskoe vospitanie raznykh grupp naseleniya»* [Organizational and methodological support of physical education of female students taking into account the ovarian-menstrual cycle: PhD thesis abstract], Kiev, 22 p. (in Russ.)
- Klimenko, A.V. (2003), "Psychophysiological changes in the functional state of female students in the process of physical education", *Nauchno-metodicheskie i prakticheskie osnovy podgotovki spetsialistov v sovremennom tekhnicheskom vuze: sb. nauch. tr.*, Belgorod, pp. 294-299. (in Russ.)
- Loza, T.A. (1981), *Optimizatsiya protsessa obucheniya gimnasticheskim uprazhneniyam v svyazi so spetsificheskimi osobennostyami zhen-skogo organizma: avtoref. diss. na soiskanie uch. stepeni kand. ped. nauk: spets. 13.00.04 «Teoriya i metodika fizicheskogo vospitaniya, sportivnoy trenirovki, ozdorovitelnoy i adaptivnoy fizicheskoy kultury»* [Optimization of the process of teaching gymnastic exercises in connection with the specific characteristics of the female body: PhD thesis abstract], Kiev, 23 p. (in Russ.)
- Lubysheva, L.I. (2000), "Woman and Sport: Social Aspect", *Teoriya i praktika fiz. kultury*, No. 6, pp. 13-16. (in Russ.)
- Mulik, V.V. (2001), *Sistema mnogoletnego sportivnogo sovershenstvovaniya v uslozhnennykh usloviyakh sopryazheniya osnovnykh storon podgotovlennosti sportsmenov (na materiale lyzhnogo sporta): avtoref. dis. na soiskanie uch. stepeni d-ra nauk po fiz. vosp. i sportu: spets. 24.00.01 «Olimpiyskiy i professionalnyy sport»* [System of long-term sports perfection in the complicated conditions of conjugation of the basic parties of readiness of sportsmen (on a material of skiing): Doct. of Sci. thesis], Kiev, 40 c. (in Russ.)
- Mulyk, V. (2016), "Modern aspects of the construction of the training process of athletes", *Slobozans'kij naukovno-sportivnij visnik*, No. 5(55), pp. 57-62, doi: 10.15391/snsv.2016-5.010. (in Ukr.)
- Platonov, V.N. (2015), *Sistema podgotovki sportsmenov v olimpiyskom sporte. Obshchaya teoriya i ee prakticheskie prilozheniya: ucheb-nik dlya trenerov [Athletes Training System for Olympic Sports. General theory and its practical applications: a textbook for trainers]*, in 2 books, Book 2, Olimp. lit., Kiev. (in Russ.)
- Polyakova, T.M. & Yurchik, N.A. (1991), "Dependence of CMC, biorhythms and effectiveness of shooting female shooters in the conditions of competitions", *Problemy sovremennoy nauchno-issledovatel'skoy raboty v sfere fizicheskoy kultury: mater, itogovoy nauch. konf.*, BGOIFK, Minsk, pp. 121-122. (in Russ.)
- Pokholenchuk, Yu.T. & Svechnikova, N.V. (1987), *Sovremennyy zhenskiy sport* [Modern Women's Sport], Zdorove, Kiev. (in Russ.)
- Prudnikova, M.S. & Mulik, V.V. (2009), "Influence of physical loads on the functional state and personal qualities of young cyclists 12–15 years in the period of formation of the CMC", *Slobozans'kij naukovno-sportivnij visnik*, No. 3, pp. 164-167. (in Russ.)
- Radzievskiy, A.R., Loza, T.A. & Bamutov, A.N. (1975), "Anatomico-physiological features of the female body", *Zhenskiy sport: sb. nauch. rabot*, Kiev, pp. 10-34. (in Russ.)
- Chernov, S.S. (1985), *Rezhimy trenirovochnykh nagruzok v mezotsikle u sportsmenok v bege na srednie distantsii: avtoref. diss. na soiskanie uch. stepeni kand. ped. nauk: spets. 13.00.04 «Teoriya i metodika fizicheskogo vospitaniya, sportivnoy trenirovki, ozdorovitelnoy i adaptivnoy fizicheskoy kultury»* [Modes of training loads in the mesocycle in athletes in the run at medium distances: PhD thesis abstract], Moscow, 22 p. (in Russ.)
- Shakhlina, L.G. (2002), *Mediko-biologicheskie osnovy upravleniya protsessom sportivnoy trenirovki zhenshchin* [Medical and Biological Principles for Managing the Process of Women's Sports Training], Naukova dumka, Kiev. (in Russ.)
- Shakhlina, L.G. (1995), *Mediko-biologicheskie osnovy upravleniya protsessom sportivnoy trenirovki zhenshchin: avtoref. diss. na soiskanie uch. stepeni doktora ped. nauk: spets. 13.00.04 «Teoriya i metodika fizicheskogo vospitaniya, sportivnoy trenirovki, ozdorovitelnoy i adaptivnoy fizicheskoy kultury»* [Medico-biological principles of the management of the process of sports training of women: Doct. of Sci. thesis], Kiev, 32 p. (in Russ.)
- Botella-Lyusia, J. (1973), *Endocrinology of Woman*, W.B. Saunders Co., Philadelphia, PA.
- Byrne, H.K. & Wilmore, J.H. (2001), "The effects of a 20-week exercise training program on resting metabolic rate in previously sedentary, moderately obese women", *Int. J. Sport Nutr. and Exercise Metab.*, No. 11(1), C. 15-31, available at: <https://www.ncbi.nlm.nih.gov/pubmed/11255134>
- Pate, R.R., Sparling, P.B., Wilson, G.E., Cureton, K.J. & Miller, B.J. (1987), "Cardiorespiratory and metabolic responses to submaximal and maximal exercise in elite women distance runner", *Int. J. Sport Med.*, No. 8, suppl 2, pp. 91-95, available at: <https://www.ncbi.nlm.nih.gov/pubmed/3692658>

Received: 15.07.2017.
Published: 31.08.2017.

Information about the Authors

Yevheniia Dzhym: *Kharkiv State Academy of Physical Culture: st. Klochkivska, 99, Kharkov, 61058, Ukraine.*
ORCID.ORG/0000-0002-4869-4844
E-mail: djimvictor@gmail.com