



Anatomical-Anthropometric and Morphofunctional Adaptation Changes in Sexual Somatotypes in Young Female Athletes Engaged in Martial Arts

Bugaevsky KA*

Department of Medical and Biological Foundations of Sports and Physical Rehabilitation, The Petro Mohyla Black Sea State University, Nilolaev, Ukraine

***Corresponding Author:** Bugaevsky KA, Assistant Professor, Department of Medical and Biological Foundations of Sports and Physical Rehabilitation, The Petro Mohyla Black Sea State University, Nilolaev, Ukraine.

DOI: 10.31080/ASAT.2024.03.0153

Received: August 22, 2024

Published: September 13, 2024

© All rights are reserved by

Bugaevsky KA.

Abstract

The article presents the results of a study on the inversion of sex somatotypes obtained from female athletes adolescents engaged in four types of martial arts. 56 women participated in the research. It was found that in female athletes of adolescents engaged in single combat, in the values of the index of sexual dimorphism and in sexual somatotypes, the andromorphic and mesomorphic sexual somatotypes prevalent in 39 (69.64%) prevail. Ginekomorphic sexual somatotype is defined in 17 (30.36%) adolescents female athletes. In all four groups, 30 (53.57%) young athletes have high enough values of mesomorphic sexual somatotype indicators as markers of somatic adaptive processes. The results obtained from the study suggest that the occurring somatic processes are adaptive changes in the body of young female athletes, under the influence of intense physical and psycho-emotional stresses on them.

Keywords: Female Athletes; Adolescent/Young Age; Index of Sexual Dimorphism; Sexual Somatotypes; Adaptation; Martial Arts

Introduction

Today, it has become common for women of all ages to engage in physical culture and sports en masse. It has already become commonplace for women to actively participate in sports that were previously considered to be primarily male [6,7,16]. Young women's "mastering" of various martial arts, such as freestyle and Greco-Roman wrestling, taekwondo, kickboxing, and pankration, are no exception to this process [8,9,13,16]. When selecting for these sports, many coaches focus on selecting athletes with the characteristics of sportswomen "masculine candidates", with strength, endurance, reaction speed, coordination and a number of other physical and mental indicators related to male characteristics [1,5,10].

During training and competitions, with their intense physical and psycho-emotional stress, with an early start to practicing these sports (before the onset of menarche and the establishment

of the ovarian-menstrual cycle), a sufficiently large number of female athletes in puberty and adolescence develop non-feminine sexual somatotypes (mesomorphic and andromorphic), often combined with negative changes in the dynamics of the ovarian-menstrual cycle (OMC), changes in the timing of puberty, late menarche, the formation and stabilization of hypomenstrual syndrome, with its characteristic phenomena of oligo-opso, hypomenorrhea, algodysmenorrhea, premenstrual syndrome, and in some cases the formation of secondary amenorrhea [1-3,6,13,14].

The following authors and researchers study the issues of sports selection, adaptive changes, development and formation of sexual somatotypes and manifestations of sexual dimorphism and masculinization in modern women's sports: M.A. Vershinin, S.V. Vandyshev, 2013; D.A. Zaitsev, Yu.P. Ivonina, 2013; A.V. Kolyada, 2013; L.A. Lopatina, N.P. Serezhenko, Zh.A. Anokhina, 2013; E.A. Oleinik, A.A. Dyusenova, 2013; V.B. Mandrikov, E.V. Zubareva, E.S.

Rudaskova., *et al.* 2014; N.D. Nenenko, O.A. Abramova, N.V. Chernitsyna, R.V. Kuchin, 2014; E.F. Kochetkova, O.N. Oparina, 2014; V.B. Mandrikov, R.P. Samusev, E.V. Zubareva., *et al.* 2015; M.G. Tkachuk, A.A. Dyusenova, 2015; K.A. Bugaevsky, 2014-2024. The problem of gender; changes in a number of psychological indicators (aggression, anxiety, hostility, etc.) is studied by such researchers in sports psychology as O.G. Lopukhova, 2013; E.A. Tarasevich, 2016, K.A. Bugaevsky, 2017-2024.

The issues of adaptation to training and competition loads, loss of fat mass, restructuring of the endocrine system and metabolism, changes in the process of neuro-humoral regulation of processes in the body of young female athletes, ultimately lead to the formation of new sexual somatotypes for female athletes [4,7,9,14]. Often, this process, in parallel, occurs at the psychological level, with the formation of gender changes in the personality type in female athletes [8,12,15]. We found practically no research papers devoted to the study of the issues of the formation of changes in sexual somatotypes in young female athletes involved in many modern types of martial arts. Conducting a comparative analysis of the obtained results of changes in the indices of sexual dimorphism according to the classification of J. Tanner and W. Marshall will help both specialists in the field of morphology, sports medicine, and coaches and the female athletes themselves to better understand the mechanism of adaptive processes occurring during intense physical activity in the body of young athletes engaged in various types of martial arts.

In this paper, we would like to focus on the examination of the processes of adaptive changes in sexual somatotypes, according to the values of the sexual dimorphism index, in adolescent female athletes involved in such types of martial arts as: freestyle wrestling, taekwondo, kickboxing, pankration.

Aim of Study

The aim of the article is to present an analysis of the results of the conducted study, according to the obtained anatomical and anthropometric values, the values of the sexual dimorphism index in adolescent female athletes representing four types of martial arts.

Hypothesis of the study

In the process of preparing and conducting this study, its author came up with a working hypothesis, the essence of which was as

follows: with regular, intensive training in this type of sport, with intensive and long-term, permanent physical and psycho-emotional loads, young athletes experience various, individual, adaptive changes, often combined, both anatomical-anthropometric and morphofunctional.

Research objectives

- To identify and analyze the possible, existing, individual, both anatomical-anthropometric and morphofunctional changes in female sportsmen of adolescence in a number of weight categories.
- For this: 2. To conduct individual anthropometry and pelviometry of female athletes in their weight categories.
- Based on the data obtained, to determine the existing anatomical-anthropological and morphofunctional changes in their sexual somatotypes and weight categories.
- To analyze the obtained values and establish the relationship between the existing adaptive changes and inversions in the somatotypes of adolescent/young female sportsmen.
- To try to establish the relationship between the identified anatomical-anthropological and morphofunctional changes and inversions of sexual somatotypes, with intense physical and psycho-emotional stress associated with the training and competition process, in the studied group of female sportsmen of adolescent/young age.

Material and Methods

This study was conducted at a number of sports clubs and sports sections in Ukraine that train female athletes of different age groups and weight categories in the martial art. The study involved female adolescent athletes (n = 109) who were actively involved in this sport. To achieve the goal of the study, we used anthropometric methods such as determining the shoulder width (SW) and the pelvic width (PW), which are necessary to determine such a morphological index value as the sexual dimorphism index (SDI) according to J. Tanner. According to the obtained index values, somatotyping was carried out in female athletes, based on the criteria corresponding to the classification of J. Tanner and W. Marshall (Martirosov, Rudnev and Nikolaev, (2010). The values of the index of sexual dimorphism (SDI) are calculated according to their, the author's formula: $3 \times \text{biacromial sizes}$, or the width of the shoulders, minus the pelvic-crest size (d. cristarum), or the width of the pelvis.

We used as a basis the index values proposed by these researchers for women, namely: gynecomorphic sexual somatotype - less than 73.1; mesomorphic sexual somatotype - 73.1-82.1) and andromorphic sexual somatotype - more than 82.1 (Martirosov, Rudnev and Nikolaev, (2010). Mesomorphic and andromorphic sexual somatotypes are inversions, or pathological shifts, not characteristic of the basic gynecomorphic sexual somatotype [12]. We also assessed the state of a number of pelviometry data: determination of three transverse – d. spinarum, d. cristarum, d. trochanterica and 2 longitudinal (c. externs and c. vera – external dimensions of the bony pelvis of female athletes, in all three weight groups of judokas. In addition, the indicators of such morphofunctional index values were determined as the sexual dimorphism index (SDI), according to the method of J. Tanner and W. Marshall, as modified by E.P. Sharaikina (2005) [3-22].

Abbreviation

- SW - Shoulder width;
- PW - Pelvic width;
- SDI - Index of sexual dimorphism, according to the method of J. Tanner and W. Marshall, as modified by E.P. Sharaikina;
- MS - Master of Sports;
- CMS - Candidate Master of Sports.

This study was conducted at a number of training centers for female athletes in the above-mentioned martial arts in Nova Kakhovka, Kherson region. A total of 56 athletes took part in the study: freestyle wrestling (n = 16), taekwondo (n = 14), kickboxing (n = 14), pankration (n = 12). We determined a number of anthropometric indicators (body length, body weight, shoulder width, pelvic width), calculated the values of the sexual dimorphism index using the method of J. Tanner and W. Marshall, followed by determination of sexual somatotypes, analysis of available scientific and scientific-methodical literature, method of mathematical statistics. All female athletes who took part in the study gave their voluntary, both verbal and written consent. The study involved female athletes (n = 14) of adolescent age involved in kickboxing. The average age of the athletes in the study group was 20.26 ± 0.35 years, which corresponds to adolescence [1]. The duration of training in this sport ranged from 5 to 12 years. After determining the dimensions of the shoulder width (SW) and the pelvic width (PW), we conducted somatotyping in a group of adolescent female athletes. The obtained data on the distribution of female athletes by sex somatotypes according to J. Tanner and W. Marshall [4,9,11,16] are presented in Table 1.

Name of the indicator	Andromorphic sexual somatotype	Mesomorphic sexual somatotype	Gynecomorphic sexual somatotype
Sportswomen - kickboxing (n = 14)	3 sportswomen - kickboxing (21,43%)	9 sportswomen - kickboxing (64,28%)	2 sportswomen - kickboxing (4,29%)

Table 1: Sexual somatotypes in female kickboxers.

The average value of the SDI indices in this group of female athletes was 81.43 ± 0.78. This corresponds to the values of the mesomorphic somatotype (73.1–82.1) [4,9,11,16]. The total number of female athletes of non-feminine sexual somatotypes (mesomorphic and andromorphic) constituted the overwhelming majority of athletes in the study group – 12 (85.71%). In the group of girls involved in kickboxing, the number of female athletes with the mesomorphic sexual somatotype dominates – 9 (64.28%), which exceeds the number of female athletes of other somatotypes.

The study also involved 16 teenage female athletes involved in freestyle wrestling. The average age of the athletes (n = 16) was 19.67 ± 0.24 years. The girls have the following sports qualifications: Master of Sports (MS – 1) (Champion of Ukraine among juniors in the weight category up to 48 kg), Candidate Master of Sports (CMS) – 1 (Champion of Ukraine among juniors in the weight category up to 53 kg), 1st category – in 14 athletes. The results of the study reliably determined that in the group of girls involved in freestyle wrestling (n = 16) the IPD value in the entire study group was 68.19 ± 3.89, which corresponds to the gynecomorphic type

[4], pp. 18-22; 9, pp. 59-62; 11, pp. 504-508; 16. However, it was determined that there were 9 (56.25%) gynecomorphs female athletes in the study group, 5 (31.25%) mesomorphs, and 2 (12.50%) andromorphs.

In the group of female athletes of adolescent age (n = 12) engaged in pankration, we obtained the following data: the average age of the athletes was 20.04 ± 0.75 years. The duration of pankration training was from 3.5 to 5.8 years. The level of sports qualification was from the 1st category to CMS and MS. The intensity of training sessions was 4-5 times a week, for 2.5-3 hours. Competitive experience was from 1.5 to 3 years. Based on the results

of the study, it was reliably determined that in the group of girls engaged in pankration (n = 12), the SDI value in the entire study group was 67.48 ± 2.72, which corresponds to the gynecomorphic type [4,9,11,16]. There were 1 (8.33%) female athletes with an andromorphic sexual somatotype, 7 (58.33%) with a mesomorphic somatotype, and 4 (33.33%) with a gynecomorphic sexual somatotype. The study also involved female athletes of adolescent age (n = 14) practicing taekwondo. The average age of the athletes in the group was 20.26 ± 0.35 years. The duration of training in this sport was 5-12 years. The data on the distribution of female athletes by sex somatotypes according to the classification of J. Tanner [4,9,11,16] are presented in Table 2.

Name of the indicator	Andromorphic sexual somatotype	Mesomorphic sexual somatotype	Gynecomorphic sexual somatotype
Sportswomen taekwondo (n = 14)	Sportswomen taekwondo (21,43%)	9 Sportswomen taekwondo (64,28%)	2 Sportswomen taekwondo (14,29%)

Table 2: Sex somatotypes of female athletes practicing taekwondo.

In young female athletes, with increasing age, duration of their taekwondo training and improvement of their sports qualifications, there are sharp changes in the values of the SDI indicators and in the presence of non-female sexual somatotypes. The total number of female athletes with andromorphic and mesomorphic sexual somatotypes is 12 (85.71%) of all athletes in this group (n = 14). The average value of the SD {indicators in the group of female athletes was 81.43 ± 0.78 (p < 0.05). This corresponds to the values of the mesomorphic somatotype (73.1-82.1) [4,9,11,16]. The number of mesomorph female athletes is quite high, which indicates the intensity of their somatic changes aimed at androgenization of their body, associated with the duration and intensity of physical and psycho-emotional stress in their sports activities [4,6,7,9,11,16].

When examining the distribution of sexual somatotypes in all four types of martial arts that female adolescent athletes practice, we obtained the following results: mesomorphic sexual somatotype – 30 female athletes (53.57%); gynecomorphic sexual somatotype – 17 female athletes (30.36%); andromorphic sexual somatotype – 9 female athletes (16.07%).

A clear fact is the fairly high number of mesomorph female athletes, which indicates the intensity of their somatic changes aimed

at androgenization of their body, associated with the duration and intensity of physical and psycho-emotional stress in their sports activities and the presence of female athletes of andromorphic sexual somatotypes in all 4 groups. Representatives of these sexual somatotypes are most often winners of competitions, more active when increasing the intensity of training and competitive loads [4,6,7,9,11,16].

Conclusions

- In adolescent female athletes involved in martial arts, in the values of the sexual dimorphism index and in sexual somatotypes, the andromorphic and mesomorphic sexual somatotypes predominate, determined in 39 (69.64%) female athletes, the gynecomorphic somatotype was determined in 17 (30.36%) female athletes.
- In all four groups of athletes, fairly high values of the mesomorphic sexual somatotype indicators were noted, as a marker of somatic adaptive processes occurring in young female athletes.
- These somatic processes can be assessed as adaptive changes occurring in the body of young female athletes under the influence of intense physical and psycho-emotional stress.

Bibliography

1. Bugaevsky KA. "Peculiarities of age-related changes in a number of anthropological indicators and index values in young female athletes engaged in free-style wrestling". *Sports Bulletin of Pridneprovya 2* (2016): 20-28.
2. Bugaevsky KA and Cherepok AA. "Peculiarities of a number of reproductive indicators in young female athletes engaged in taekwondo". Strategy for the formation of a healthy lifestyle by means of physical culture and sports. "Sport for all" and the introduction of the All-Russian physical culture and sports complex "GRT". Proceedings of the International Scientific and Practical Conference dedicated to the memory of Professor V.N. Zuev. Tyumen: "Vector Book", (2017): 253-256.
3. Bugaevsky KA. "Consideration of the features of the menstrual cycle in athletes involved in pankration". *Ukrainian Journal of Medicine, Biology and Sports 5.7* (2017): 186-195.
4. Bugaevsky KA. "Features of the values of a number of reproductive indicators and sexual dimorphism in female students involved in kickboxing". Student, Healthy Sport. Materials of the Regional Scientific and Practical Conference of Students and Young Scientists (collection of scientific works). View "Nova Ideology", Dnipro (2017): 18-22.
5. Vershinin MA and Vandyshev SV. "The concept of complex sports selection in taekwondo". *Fundamental Research 11-4* (2013): 751-756.
6. Mandrikov VB., et al. "Dependence of manifestation of morphological signs of masculinization of female athletes on the type of constitution". *Bulletin of VolGGMU 1.49* (2013): 40-43.
7. Zaitsev DA and Ivonina YuP. "Morphological indicators of sexual dimorphism in female athletes of different body types". *Bulletin of the Magistracy 2.17* (2013): 7-9.
8. Nenenko ND., et al. "Study of gender-dependent characteristics of female athletes, representatives of feminine, masculine and neutral sports". *Modern Problems of Science and Education 6* (2014): 15-25.
9. Kolyada AV. "Some prospects for the development of women's kickboxing taking into account sexual dimorphism". Priority scientific areas: from theory to practice: collection of materials of the VIII Int. scientific and practical conference, Novosibirsk (2013): 59-62.
10. Kochetkova EF., et al. "Features and problems of sexual dimorphism in sports". *Modern Scientific Research and Innovation 7* (2014): 15-20.
11. Lopatina LA., et al. "Anthropometric characteristics of girls according to the classification of J. Tanner". *Fundamental Research 12-3* (2013): 504-508.
12. Lopukhova OG. "Questionnaire "Masculinity, femininity and gender personality type" (Russian analogue of "Bem sex role inventory)". *Questions of Psychology 1* (2013): 1-8.
13. Mandrikov VB., et al. "On the issue of inversion of sexual dimorphism indices in representatives of masculine sports". *Bulletin of VolGGMU 4.56* (2015): 76-78.
14. Oleynik EA and Dyusenova AA. "Somatological and endocrinological features of female athletes involved in wrestling and boxing". Scientific notes of P.F. Lesgaft University 2.96 (2013): 116-120.
15. Tarasevich EA. "Gender differences of athletes in various classification groups of sports and sports disciplines". *Slobozhansky naukovо-sportivny vicnik. - Kharkiv: KhDAFK 2.52* (2013): 117-120.
16. Tkachuk MG and Dyusenova AA. "Sexual dimorphism and its reflection in sports: monograph". Moskow-Berlin: Direct-Media, (2015): 111.