



Peculiarities of the Bone Gospel in Somatotypes in the Sportsman of Young-Born Age with the Tennis

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Abstract

The article presents the results of a study devoted to the study of individual features of the size, types and structure of the bone pelvis, in sexual somatotypes, in athletes of adolescents engaged in tennis. According to the results of the study, it was determined that in the study group there are manifestations not only of inversion of sexual somatotypes, but also numerous, often combined variants of violations, both in proportions of sizes and shapes and types of pelvis in athletes of adolescence.

Keywords: Female Athletes; Youthful Age; Sexual Dimorphism; Sex Somatotypes; Bone Pelvis; The Size of the Pelvis; Narrow Pelvis

Abbreviation

WS: Width of Shoulders; WP: Width of Pelvis; SDI: Sexual Dimorphism Index; RSWI: Relative Shoulder Width Index; RPWI: Relative Pelvic Width Index; PBI: Pelvic Bone Index; RSWI: Relative Shoulder Width Index; PI: Pelvic Index; ANP: Anatomically Narrow Pelvis; TNP: Transversely Narrow Pelvis; PFP: Plain Flat Pelvis; GUNP: General Uniformly Narrow Pelvis; APS: Anatomically Narrow Pelvis; KMS: The Candidate for Master of Sports; MS: Master of Sports

Introduction

Modern women's sports, both top and amateur, require athletes to work hard, with frequent and intensive training. This cannot but affect the performance of their bodies. An abundance of intense physical and psycho-emotional loads, without proper compensation and medical supervision, inevitably leads to adaptive changes in the body of female athletes of different age groups [1-4,9]. Thus, the most vulnerable and subject to intensive somatic and psychological changes are young female athletes, especially pubertal age, who have begun sports activities before menstruation, as well as female athletes of adolescent age [1-3,9]. The study of the adaptation changes arising in female athletes under the influence of

sports, and sometimes inadequate, physical and psycho-emotional loads to which they are exposed during training and competition, is always relevant and in demand [1-4,9]. The author's works of recent years are presented by the results of studies devoted to anatomical-anthropological and morphofunctional features of the body of female athletes of all age groups, mainly, the features of a number of values of their reproductive, endocrine and cardio-respiratory systems. [1-3]. The study of anthropometric indices and morphological index values of the female athletes' bone pelvis in their ontogenesis is an exception [1-4,9].

In recent years, numerous scientific studies have pointed to serious shifts in the body of female athletes, in which various disorders occur in the endocrine, reproductive and bone systems [2,3]. In particular, in female athletes, intense physical activity leads to changes in the timing of bone 'maturation' and bone formation, including pelvic, and disrupts the closure of the ossification zones (nuclei) in the epiphyses of the tubular bones responsible for the length of the human body [2,3]. Intense physical and psycho-emotional stress, occurring in girls, with intensive sports activities, during the prepubertal and prepubertal period, and continuing into

adolescence, can lead to violations of anatomical, morphological and functional character in the bone pelvis, which is manifested by abnormal changes in its size, volume and function related to the placement of female pelvic organs in it, as well as related to the location and biomechanics of fetal birth as it passes through the bony pelvic birth canal [1,4]. In terms of intensity and amount of physical activity, dance sport is no exception in the formation of the female pelvis, where sometimes female athletes experience not always adequate, in terms of strength and duration, loads during the entire period of tennis [2,5-7].

It should be noted that there are a sufficient number of studies concerning physical performance, anthropological parameters and technical criteria of training tennis players of different age groups [3-5]. However, in the available scientific and scientific-methodological literature we did not find any data devoted to the study of gender dimorphism manifestations in young female tennis players. Research works devoted to the study of anatomical-anthropological and morphofunctional features of the bone pelvis in female athletes of pubertal and adolescent age in individual competitive sports, in particular in tennis players, are rare [3-5]. We would like to note the works devoted to morphofunctional features and problems of sexual dimorphism in female athletes, including tennis players, of such researchers as: DA. Zaitsev, YP. Ivonina, 2013; LA. Lopatina, NP. Serezhenko, ZhA. Anokhina, 2013; S Y. Nadeina, VM. Klotz, LA. Zvyagintseva, *et al*, 2014; ND. Nenenko, OA. Abramova, NV. Chernitsina, RV. Kuchin, 2014; EF. Kochetkova, ON. Oparina, 2014; VB. Mandrikov, *et al.*, 2015; Bugaevsky KA., 2014-2018. Issues related to the study of morphofunctional and anatomo-anthropological studies of the bone pelvis, both in female athletes and in the population, are devoted to the studies of such authors as: NI. Kovtyuk, 2004; VG. Nikolaev, NN. Nikolaeva, LV. Sindeeva, LV. Nikolaeva, 2007; OV. Syrova, TM. Zagorovskaya, AV. Andreeva, 2008; VA. Yashvorskaya, MI. Levitsky, 2012; OV. Tyan, LV. Stklyanina, LD. Savenko, 2012; KA. Bugaevsky, 2014-1018.

Highlighting the previously unresolved parts of the general problem. A number of researchers of this problem indicate the existing changes in the bone pelvis of female athletes, in the form of a variety of forms of narrow pelvis, anatomically narrow pelvis, their "erased" forms, with I-II degrees of contraction [2, p.42-46]. There are practically no fundamental, systematic scientific studies concerning the polyetiological moments of changes in the bone pelvis of female athletes in their ontogenesis. Therefore, we believe that peculiarities of knowledge of sexual somatotypes, anthropomet-

ric and morphological features of bone pelvis structure of young female tennis players can help to improve not only their level of sportsmanship but also preserve their somatic and reproductive health. This fact determined the urgency of our study as from the side of searching for new data on the adaptation and vital activity peculiarities as well as in the issue of preventive measures of reproductive pathology of the sportswomen of the given age group.

Aim of the work

The aim of the study was to investigate the anatomical, anthropometric and morphological parameters and their changes occurring in female athletes engaged in tennis by determining their variations in the size of the bone pelvis in sexual somatotypes and study and analysis of the obtained data on changes in the size, formation, structure and types of bone pelvis, and related anatomical values and morphological indicators in young tennis players.

Material and Methods

This study was conducted in 2021-2022 on the basis of sport dance clubs in Zaporozhye and Nova Kakhovka. Young (n = 15) and first reproductive age (n = 13) girls were involved in the study, a total of 28 female athletes. We used such methods as analysis of available information sources, anthropometry, with determination of shoulder and pelvic width, index method, with determination of Sexual Dimorphism Index (SDI), Relative Shoulder Width Index (RSWI), Relative Pelvic Width Index (RPWI), Pelvic Index (PI), Pelvic Bone Index (PBI), method of mathematical statistics.

Results of the Study and Discussion

To obtain the necessary information about the size of the female athletes' bone pelvis and its types, in the studied group, we applied such methods of research as pelviometry and recalculation of the obtained data, in order to obtain additional indicators, such as true conjugate (to determine the available degree of pelvic constriction), classification of narrow pelvises and their forms according to Litzman, determination of such anthropometric values as width of shoulders (WS) and pelvis (WP), to determine the type of physique in female athletes, and the index of sexual dimorphism (ISD) according to J. Tanner. Also according to the values of pelvic floor and pelvic joint, somatotyping was performed in female athletes on the basis of the criteria of Tanner's classification, namely: mesomorphic sexual somatotype (73,1-82,1), as transitional, between typical for women gynecomorphic sexual somatotype (less than 73,1) and andromorphic somatotype (over 82,1) [3-5,7-10]. Both meso-

morphic and andromorphic sexual somatotypes refer to inversions - pathological shifts of somatotypes that are not characteristic of gynecomorphic sexual somatotypes [3-5,7-10].

This study was conducted in 2021/2022, on the basis of sports clubs in Novaya Kakhovka, Kherson region, engaged in the preparation of female tennis players. Female tennis players of young age (n = 12) took part in the study. Sports qualification of the sports-women who took part in the conducted research - from the I category up to the candidate for master of sports (KMS) and master of sports (MS). The length of training in this sport - from two to seven years. Frequency of trainings - 4-6 times a week, from 2 to 4 hours. The average age of the women-athletes was 19,58±0,68 years old. It was found that 9 (75,00%) female athletes of adolescent age started their tennis lessons before menarche (first menstruation). After anthropometric measurements, with determination of parameters of width of shoulders (bicromial size) and width of pelvis (bicristarum, or d. cristarum), the following results were received, reflected in table 1.

Name of the indicator	Width of shoulders, (cm)	Width of the pelvis, (cm)
Junior female tennis players	36,87 ± 0,79	27,05 ± 0,23

Table 1: Shoulder and pelvic width indicators in the study group (n = 12).

According to the data of the analysis of the obtained results, it can be stated that in female tennis players the indices of shoulder width significantly exceed the dimensions of their pelvic width. At the same time, the values of pelvic width do not correspond to the generally recognized anatomical indicators of normal dimensions of pelvic width (distancia cristarum), equal to 28-29 cm [1,2,11,13,14]. In addition, to determine the degree of maturity of pelvic bones, we determined the pelvic bone index (PBI), as an integral indicator of the formation of pelvic bones, according to the method of N.I. Kovtyuk [6, pp. 48-49]. According to her study, the peak growth of the main dimensions of the bone pelvis occurs, on average, at 12-13 years, and coincides with the appearance of menarche (first menstruation) in girls. In this regard, the age of puberty and adolescence are critical periods in ontogenesis in the formation and maturation of the pelvic bones [2,6,12,13]. N. I. Kovtyuk found that for girls of adolescent age, the value of PBI ranges from

30.0 to 40.0 c.u., which corresponds to their age norm [2]. After the necessary anthropometric measurements and mathematical calculation of this morphological value, we obtained the following results: the average PBI value in female teenage athletes is 32.68 ± 1.06. The data obtained showed that 4 (33.33%) female teenage athletes have ICT values slightly below their age norm (from 27.5 to 29 c.u.), indicating that they are still in the process of maturation of pelvic bone structures. In the remaining 8 (66.67%) teenage female athletes the PBI values obtained, with values above 30.0 (31 to 54 cfu), indicate that the process of maturation and formation of their pelvic bone structures is complete [2,6].

After determining the anthropometric indicators of ST and ST', we conducted a mathematical calculation of the values of the index of sexual dimorphism (IPD) and the selection of sexual somatotypes in the study group, with the allocation of gynecomorphic, mesomorphic and andromorphic sexual somatotypes in female athletes [3-5,7-10]. The data on the obtained values of sexual somatotypes are presented in table 2.

Name of the indicator	Gynecomorphic sexual somatotype	Mesomorphic sexual somatotype	Andromorphic sexual somatotype
Junior female tennis players (n = 12)	2 (16,67%) sportsmens	6 (50,00%) sportsmens	4 (33,33%) sportsmens

Table 2: Distribution of female athletes by gender somatotype (n = 12).

It is noteworthy that in the studied group there are female athletes - 10 (83,33%), with detected mesomorphic and andromorphic sexual somatotypes. Only 2 (16.67%) had a preserved gynecomorphic somatotype. In addition, by interviewing the female athletes, it was found that these girls have a short sports experience - from 1 to 2.5 years. Mesomorphic and andromorphic gender somatotypes dominate in female athletes who have been engaged in sports including tennis for 3 years and more [3-5,7-10]. To identify the existing changes in the size and structure of the female athletes' pelvic bones, we performed pelvimetry, with the classical determination of the 4 external dimensions of the large bone pelvis and, indirectly, through recalculation, the value of the true conjugate: distantia spinarum (interosteal/bithuberous size) - normal 25-26 cm, distantia cristarum (intercrestal/bicrystal size) - normal 28-29 cm, d. trochanterica (intervertebral size) - normal 30-32 cm, c.

externa (external conjugate) - normal 20-21 cm, c. vera (true conjugate or direct size of pelvic entrance - normal 11 cm [1,2,11-14]. In the entire group (n = 12) we obtained pelvimetry data: d. spinarum 24.37 ± 0.81 cm, d. cristarum - 27.11 ± 0.65 cm, d. trochanterica - $31, 21 \pm 0.72$ cm, s. externa - 19.46 ± 0.47 cm, s. vera - 10.03 ± 0.34 cm ($p < 0.05$). When analyzing the results of pelvimetry, with the determination of two transverse (d. spinarum, d. cristarum) and 1 direct size (c. externa) it was reliably established ($p < 0.05$) that the indicators we obtained were less than the anatomical norms of external pelvic dimensions: d. spinarum - 25-26 cm; d. cristarum - 28-29 cm; c. externa - 20-21 cm [1,2,11-14].

The only exception is the indicators of d. trochanterica), corresponding to normal values (30-32 cm) [1, 2,11-14]. According to the results of the pelvic measurements we obtained the following pelviometric values in the study group (n = 12): in 7 (58.33%) of the studied female athletes: d. spinarum - 24.41 ± 0.65 cm ($p < 0.05$), d. cristarum - 27.68 ± 0.44 cm ($p < 0.05$), d. trochanterica 32.64 ± 0.93 cm ($p < 0.05$), c. externa 18.55 ± 0.35 cm ($p < 0.05$), c. vera 10.27 ± 0.25 cm ($p < 0.05$). All the obtained values of pelvimetry, except for the values of d. trochanterica, which are normal, are less than the normative values, indicating the presence of anatomically narrow pelvis (ANP) in this group of athletes [2, p. 42-46; 11 p. 67-73; 12, p. 45-47; 13, p. 132-133; 14, p. 56-59]. In a more detailed consideration of the obtained pelviometric values, it was possible to reliably ($p < 0.05$) establish that the indicators of d. spinarum were less than the anatomical and obstetric norm, detected in 7 (58.33%), d. cristarum - in 5 (41.67%), d. trochanterica - in 3 (25.00%), c. externa - in 7 (58.33%), c. vera - in 7 (58.33%).

It should be noted that in 7 (63,64%) female athletes, the indices of d. trochanterica exceed the normative values of this transverse dimension of the pelvis. Athletes in whom ANP was determined were assigned to the following gender somatotypes according to J. Tanner classification: andromorphic gender somatotype - 4 (33,33%), mesomorphic gender somatotype - 5 (41,67%).

In 2 (41.67%) female teenage athletes classified as gynecomorphic and in 1 (8.33%) as mesomorphic sexual somatotype (respectively - 4 (33.33%) and 1 (8.33%) were determined normal pelvic dimensions, with corresponding to normal pelvimetry [2,11-14]. Analysis of the identified variants of narrow pelvis, with different degrees of their narrowing showed that normal values of c. vera (11 cm) in the whole group, had 4 (33.33%) girls. The direct

size of the entrance to the small pelvis, or c. vera, by the values of which the degree of pelvic constriction is determined [11-14], less than 11 cm - was determined in 8 (66.67%) female athletes, transversely narrowed pelvis - in 6 (50.00%), "erased" pelvic forms - in 6 (50.00%), I degree of pelvic contraction (less than 11 cm, but more than 9 cm) [2,11-14] - in 6 (50.00%), II degree of contraction (8.5 cm) - in 2 (16.67%).

Conclusion

- The study found that in the group of female athletes of pubertal age, engaged in tennis for 3 or more years, mesomorphic and andromorphic gender somatotypes begin to form, as a result of inversion and adaptive restructuring in the bodies of 10 (83.33%) of these female athletes.
- All obtained values of 3 sizes, except the values of d. trochanterica - less than the normative values, which suggests the presence of anatomically narrow pelvis (ANP) in this group of female athletes.
- The female athletes in whom ANP was determined were referred to the following gender somatotypes: andromorphic gender somatotype - 4 (33,33%), mesomorphic gender somatotype - 5 (41,67%).
- Straight size of pelvic entrance (c. vera), less than 11 cm - was determined in 8 (66.67%) female athletes, transversely narrowed pelvis - in 6 (50.00%), "erased" forms of pelvis - in 6 (50.00%), I degree of pelvis narrowing (less than 11 cm, but more than 9 cm) - in 6 (50.00%), II degree of narrowing (8.5 cm) - in 2 (16.67%).

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