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Research Article

Studying a Series of Morphofunctional Index Values and Anthropometric Indicators in Young Sportswomen Playing Volleyball

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Abstract

This article presents the result of the study, which concerns the study of the peculiarities of the anthropometric values of the girdle of the upper and lower extremities and a number of morphofunctional index values in female athletes of adolescence who go in for volleyball. Particular attention is paid to the study of the sizes, types and forms of the bone pelvis of athletes, with the allocation of their pathological changes. It was found that in the studied group of athletes there is not a single girl with a gynecomorphic sexual somatotype, while female volleyball players with a transitional mesomorphic sexual somatotype dominate, with its maximum values close to the indices of an inverse sexual somatotype. It was recorded that in the entire group of female volleyball players a narrow pelvis was identified, mainly in the form of a generally uniformly narrowed pelvis, and the presence of a simple flat pelvis in 11 (9.74%) girls, and in 7 (6.19%), with a transversely narrowed pelvis, with I degree of its narrowing in 13 (11.50%) female volleyball players. It was determined that 49 (43.36%) female volleyball players have I degree of flat feet, and all female athletes have long and narrow feet. It was also found that the indicators of all morphofunctional index values reliably indicate the processes of hyperandrogenism and masculinization occurring in the body of female volleyball players from the study group. The revealed somatometric and morphofunctional characteristics of young female volleyball players can be interpreted as a result of preliminary sports selection, and as a direct consequence of their intense physical loads of their training and competitive sports activity.

Keywords: *Female Athletes; Young Age; Volleyball; Morphological and Functional Index Values; Anthropometric Indicators*

Abbreviations

BMI: Body Mass Index; RShWI:Relative Shoulder Width Index; RPWI: Relative Pelvic Width Index; PI: Pelvic Index; PBI: Pelvic Bone Index; AI: Andromorphy Index; IM: Index Masculinization; SDI: Sexual Dimorphism Index; Irl Indeks Rohrera; TI: Trohunter Index; SI: Soloviev Index/Diameter of the Wrist Joint

Introduction

Today's study of medico-biological characteristics of the body of athletes representing different sports and different age groups is a topical topic of scientific research. Increased competition, increased requirements for performing different volumes of physical activity, the ability to concentrate and make the most of your abilities and practical skills, in any, without exception, kind of sport, this is a chance for winning over rivals in competitions of any level [1,2]. For the successful implementation of the tasks and the ability to perform new, increased volumes of physical activity, the body of athletes, compensatory, resorts to adaptive restructuring in the work of all organs and systems of the female body: cardiovascular, respiratory, endocrine, reproductive, musculoskeletal apparatus. Taking into account the peculiarities and requirements of each of the sports, girls are selected for practicing one or another kind of sport.

During the selection, the coaching team, with the participation of a sports doctor in this process, pays attention to the age, length and body weight of the applicants, their anatomical, morphofunctional, constitutional, hereditary and psychological characteristics. Modern

women's volleyball is no exception in this matter [3,4]. Both the result of the preliminary selection and the physical loads endured by the athletes directly affect the formation of their bodies, with visible somatic and psychological changes in the structure and shape of the body, style and demeanor [5,6].

All this is the result of adaptive restructuring, which makes it possible for athletes to achieve the highest possible results for them, in this sport, in all periods of ontogenesis of athletes. For female volleyball players, their morphological structure of the body, their length and girth dimensions of the body are of great importance, first of all, it concerns the upper and lower extremities [1,7-10]. Depending on the playing role of volleyball players, there can be certain individual characteristics in total and partial body sizes. Taking into account all the above, the purpose of this study is to study a number of anatomical and, morphofunctional changes in female athletes of adolescence, which, in our opinion, are the result of adaptive changes in them, under the influence of intense physical exertion.

Materials and Methods

The study was conducted with the involvement of 113 youth volleyball players from sports clubs in several regions of Ukraine. Their average age was 20.74 ± 1.04 years, which corresponds to adolescence. Anthropometric measurements and morphofunctional index values obtained from the analysis, it should be critically noted that they differ from similar parameters in world-class athletes representing the sports elite of their countries. The level of sports paternity of volleyball players - from girls with I sports category to the level of a candidate for master of sports and master of sports. Volleyball experience – from 3 to 9.5 years. The intensity of the workouts is 5-6 times a week, 2-3 hours per workout.

We have applied such research methods as the literary analysis of available information sources, the anthropometry method, using classical methods for determining the longitudinal, transverse and girth dimensions of the body of athletes, pelvimetry, with the determination of three longitudinal and two transverse external dimensions of the bone pelvis, the method of indices, with the determination morphological and functional index values such as: body mass index (BMI), relative shoulder width index (RShWI), relative pelvic width index (RPWI), pelvic index (PI), pelvic bone index (PBI), andromorphy index (AI), index masculinization (IM), sexual dimorphism index (SDI), Index Rorhera (IR), Trohunter Index (TI), in total – 11 morphofunctional index values. When anthropometry of the upper and lower extremities girdle and width the length and girth and width of each of the components were determined – the length of the hand and foot, the length and circumference of the shoulder and forearm, lower leg and thigh, the width of the shoulders and pelvis. To process the obtained results of anthropometric measurements, the method of mathematical statistics was applied.

The study was conducted in compliance with the basic bioethical provisions of the Council of Europe Convention on Human Rights and Biomedicine (04.04.1997), the Declaration of Helsinki of the World Medical Association on the Ethical Principles of Scientific Medical Research with Human Participation (1964 - 2008), as well as the order Ministry of Health of Ukraine no. 690 dated 23.09.2009.

Results and Discussion

The following data were obtained: the average body length in the study group was 180.56 ± 1.14 cm, body weight 70.38 ± 1.47 kg. The average age of the female athletes was 20.74 ± 1.04 years. The obtained results of anthropometric measurements of the upper limb girdle, with their length and girth values, are presented in table 1.

Indicator name	Results
Shoulder width (biacromial size), cm	35,12 ± 0,37 cm
Upper limb length, cm	81,20 ± 1,73 cm
Shoulder length, cm	33,54±0,13 cm
Shoulder girth, cm	24,41 ± 0,69 cm
Transverse diameter of the distal shoulder, cm	6,89 ± 0,76 cm
Forearm length cm	25,49±0,34 cm
Forearm girth, cm	21,47 ± 0,39 cm
Transverse diameter of the distal part of the forearm, cm	6,42 ± 0,11 cm
Arm span, cm	189,83 ± 0,12 cm
Brush length, cm	17,42 ± 0,25 cm
Brush width, cm	7,14 ± 0,23 cm

Table 1: *Anthropometric Indices of the Upper Limb Girdle in the Studied Group of Female Volleyball Players (n=113).*

The ratio of the length of the shoulder to the length of the forearm was 76.26%, and the ratio of the length of the forearm to the length of the hand was 68.41%. The data regarding the arm span of the athletes showed that it exceeds their body length by almost 8.13 cm, while according to the rules of the "golden section" of Leonardo da Vinci, the arm span should be equal to the length of the human body [10,11]. Analysis of the anthropometric measurements of the young athlete`s hands showed that they have long and medium-sized palms, with long fingers.

Indicator name	Poluchennyye rezul'taty
Pelvic width (inter-crestal size), cm	26,73±0,32 cm
Lower limb length, cm	101,27 ± 1,47 cm
Thigh length, cm	55,42 ± 1,12 cm
Thigh girth, cm	44,71 ± 1,13 cm
Transverse diameter of the distal femur, cm	8,74±0,83 cm
Shin length, cm	38,61 ± 1,59 cm
Calf circumference, cm	36,28 ± 0,69 cm
Transverse diameter of the distal part of the lower leg, cm	6,72 ± 0,07 cm
Foot length, cm	33,28 ± 1,54 cm
Foot width, cm	23,37±1,27 cm

Table 2: *Anthropometric Indices of the Lower Limb Girdle in the Studied Group of Female Volleyball Players (n = 113).*

According to the results of the anthropometric measurements, it was established that young volleyball players have long and narrow feet, with elongated phalanges of the toes 49 of them had I degree of flat feet.

The individual external dimensions of the bone pelvis, in the analysis, were compared with normal indicators for this age group: transverse dimensions of the bone pelvis: iliac-spinous size (normally 25 - 26 cm), pelvic-crestal size (normally 28 - 29 cm), intertrochanteric size (normally 31 - 32 cm); longitudinal dimensions of the pelvis: external conjugate (normal 20 - 21 cm), true conjugate, normal 11 cm [10,12-15]. The pelvimetry data obtained from young female volleyball players, taking into account three transverse and two longitudinal, external dimensions of the bone pelvis, are presented in table 3.

Indicator name External dimensions of the pelvis	Results
Interspinous size (d. spinarum), cm	23,46 ± 1,01 cm
Pelvic width / inter-crestal size, (d. cristarum), cm	26,73 ± 0,32 cm
Thigh length (d. trochanterica), cm	29,73 ± 0,89 cm
External conjugate (c. externa), cm	19,92 ± 1,36 cm
True conjugate (c. vera), cm	10,54 ± 0,83 cm

Table 3: *External Dimensions of the Bone Pelvis in the Studied Group of Female Volleyball Players (n=113).*

The analysis of anthropometric measurements indicates that the athletes have anthropometric signs of an anatomically narrow pelvis, with a decrease in both all transverse and all longitudinal external dimensions of their bony pelvis, in the manner of a generally uniformly narrowed pelvis. At the same time, in the study group, there were 11 (9.74%) girls with a simple flat pelvis, and 7 (6.19%), with a transversely narrowed pelvis. In 13 (11.50%) young female volleyball players, I degree of pelvic contraction was determined [1,10,13,15,16].

After carrying out all the necessary anthropometric measurements, we determined all the morphological and functional index values required in this study. The results obtained are presented in table 4.

Indicator name	Results
Body Mass Index (BMI)	21.71 ± 0.92 kg/cm^2
Relative Shoulder Width Index (RShWI)	19,53 ± 0,31
Relative Pelvic Width Index (RPWI)	14,89 ± 0,23
Andromorphy Index (AI)	45.23 ± 0.51
Index Masculinization (IM)	1.16 ± 0.73
Sexual Dimorphism Index (SDI)	79.42 ± 1.13
Indeks Rohrera (IR)	11.92 ± 0.21
Pelvic Index (PI)	103.42 ± 1.05
Pelvic Bone Index (PBI)	45.57 ± 0.34
Trohunter Index (TI)	1.99 ± 0.32
Soloviev index / diameter of the wrist joint, (SI)	14.07 ± 0,23

Table 4: *Indicators of Morphofunctional Index Values in the Studied Group of Female Volleyball Players (n=113).*

BMI values in the studied group of female athletes indicate a sufficient ratio of body weight and length [1,2,14,15,17,]. The obtained value of MI in the study group indicates an intensive process of hyperandrogenization that occurs in female volleyball players, with a shift in their sexual somatotypes from physiological to inverse ones [2,14,15,17,]. SDI indices are located within the values of the mesomorphic sex somatotype and andromorphic sex somatotype. In the study group, not a single sportswoman with a physiological for girls of this age category, gynecomorphic sexual somatotype, was found [1,2,9,10,12]. The obtained TRI indicator indicates the processes leading to a shift in the sexual constitution in young volleyball stocks, from the values of the average sexual constitution to the values corresponding to the parameters of a strong sexual constitution [1,12,15-17,]. The values of IT among athletes are at the level of the upper values corresponding to a narrow pelvis [1,12,14]. The RPWI value in the entire study group corresponds to the values indicating the presence of a narrow pelvis in athletes [1,12,15-17,]. The value of RShWI, or morphine index for women, indicates a dolichomorphic constitution in the studied group of young female volleyball players [1,12,15-17,]. The average value of IR in female athletes corresponds to the indicators of harmonious physical development [1,12,15,17,]. The received PBI indices indicate that in all young female volleyball players the process of formation and maturation of all pelvic bones is completed, and their bone pelvis is a formed bone formation of the skeleton and girdle of the lower extremities [1,12,15,17,18].

Conclusion

- In the studied group of athletes there is not a single girl with a gynecomorphic sexual somatotype, while female volleyball players with a transitional mesomorphic sexual somatotype dominate, with its maximum values close to the indices of an inverse sexual somatotype.
- It was found that in the entire group of female volleyball players a narrow pelvis was determined, mainly in the form of a generally uniformly narrowed pelvis, and the presence of a simple flat pelvis in 11 (9.74%) girls, and in 7 (6.19%), with a transversely narrowed pelvis, with I degree of its narrowing in 13 (11.50%) female volleyball players.
- It was determined that 49 (43.36%) female volleyball players have I degree of flat feet, and all female athletes have long and narrow feet.

- It was found that the indices of all morphofunctional index values reliably indicate the processes of hyperandrogenism and masculinization occurring in the body of female volleyball players from the study group.
- The revealed somatometric and morphofunctional characteristics of young female volleyball players can be interpreted as a result of preliminary sports selection, and as a direct consequence of their intense physical loads of their training and competitive sports activity.

Conflict of Interest

The author notes the complete absence of any conflicts of interest.

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