

Anthropometry and Morphology of the Upper Limbs in Female Athletes in Team Sports

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Abstract

The article presents the results and analysis of the study, dedicated to the determination of the features of several morphological and functional index values of the shoulder girdle and upper extremities in athletes involved in basketball, volleyball and handball. It has been reliably determined that female basketball players have the highest indices of index values, in comparison with volleyball and handball players.

Keywords: Sportswomen; Playing Sports; Anthropometric Measurements; Morpho functional Index Values; Shoulder Girdle; Upper Limb

Abbreviations

BMI: Body Mass Index; SDI: Sexual Dimorphism Index; SI: Soloviev Index (Diameter of the Wrist Joint); ALI: Arm Length Index; ShWi: Shoulder Width Index; BrI: Brachial Index

Introduction

Mass engagement in various sports, women of different age groups, has become commonplace today. Girls, starting from the prepubertal and pubertal period, actively and en masse go to sports sections, which allows the coaching team, with the participation of sports doctors, to conduct a professional selection of candidates for practicing a specific sports discipline [2, p. 36-39; 3, p. 80-87]. When selecting for team sports, such as basketball, volleyball and handball, there are also criteria for the selection of applicants, among which the morphological features of the upper and lower extremities are of great importance [8; 9, p. 228-229]. It is generally known that the length of the body of female athletes is of leading importance in such team sports like volleyball and handball and, in particular, basketball. Tall athletes dominate in these sports [4; 8; 9, p. 228-229; 10, p. 107-113]. The length and girth of the athlete's shoulder and forearm, the length and width of the hand, the working right and/or left hand, are important in the technique of performing a number of specific techniques in each of these sports. Also, according to some researchers, the relationship between each part of the athlete's body is of great morphofunctional importance, which stabilizes by about 15 years, as puberty [4; 11, p. 94-98; 12, p. 22-28; 13, p. 73-79]. Serving the ball, building a block, throwing into the basket or at the opponent's goal, this is only a small part of the game "work" those athletes perform in the process of playing basketball, volleyball and handball. So, in basketball, such an anthropometric parameter as the arm span is of decisive importance for the sports role of an athlete and her place on the field - center, defense or attack [5; 6, p. 185-192; 9, p. 228-229; 14, p. 112-115]. In connection with the above, the study of medico-biological and anatomical-morpho functional features of the upper limb girdle in athletes, in these team, game sports, is very relevant and in demand, both in sports morphology and in several other related biomedical disciplines.

Purpose of the Study

Presentation of the results obtained and their analysis concerning the study of morpho functional and anatomical features of the upper limb girdle in athletes playing basketball, volleyball and handball.

Materials and Research Methods

In carrying out this research work, we used the method of in-depth literary-critical analysis of available scientific sources of information on the issue under study, using reference books, encyclopedias, catalogs, specialized periodicals, and Internet resources.

The study involved 72 female athletes who are actively involved in such game, team sports as basketball - 23 female athletes; volleyball - 25 female athletes; and handball - 24 female athletes. Their average age was, respectively - 22.73 ± 1.12 years; 23.07 ± 1.14 years; and 21.97 ± 1.34 years. The duration of these sports is from 4.5 to 10 years. The level of sports qualification - from the I sports category - 29 athletes (40.28%) of the total number of athletes; candidates for master of sports - 27 (37.5%) and master of sports - 16 (22.22%). The frequency of training is 5 - 6 times a week, for 2-2.5 hours. This research was carried out in a number of sports clubs and clubs of the Nikolaev and Kherson regions, subject to absolute voluntariness, both on the part of the athletes themselves, and with the consent and active support of the coaching teams.

Results of Research and Discussion

After carrying out the anthropometric measurements necessary for this study, which were carried out according to the classical method, the indicators were obtained, which are presented in the table 1, at $p < 0.05$.

Indicator Name	Basketball Players (n = 23)	Volleyball Players (n = 25)	Handball Players (n = 24)
Body length, cm	192.77 ± 1.36	179.35 ± 1.13	177.03 ± 1.11
Bodyweight, kg	82.03 ± 0.74	73.23 ± 1.08	71.54 ± 1.29
Shoulder width, cm	36.43 ± 1.04	35.53 ± 1.27	35.67 ± 1.14
Upper limb length, cm	81.88 ± 1.04	74.19 ± 1.63	73.43 ± 1.34
Arm span, cm	193.37 ± 1.12	178.23 ± 1.56	176.39 ± 1.33
Shoulder length, cm	33.45 ± 1.97	32.47 ± 1.53	31.65 ± 1.47
Shoulder girth at rest, cm	26.53 ± 1.14	25.88 ± 1.26	25.63 ± 1.41
Forearm length, cm	24.47 ± 1.66	23.47 ± 1.54	22.93 ± 1.74
Forearm girth, cm	25.47 ± 1.09	24.67 ± 1.16	24.97 ± 1.28
Brush length, cm	21.37 ± 1.14	16.81 ± 1.92	17.05 ± 1.77
Brush width, cm	8.66 ± 1.37	8.47 ± 1.08	8.33 ± 1.36
Pelvis width, cm	27.14 ± 0.67	27.56 ± 0.38	27.51 ± 0.11

Table 1: Anthropometric indicators in female athletes of the studied groups.

The analysis of the obtained results of the conducted anthropometry showed that basketball players can be attributed, in terms of body length, to very tall athletes, and volleyball players - to high growth athletes [4; 6, p. 185-192; 7, p. 47-54; 13, p. 73-79]. Basketball players also had the greatest bodyweight, then volleyball players and handball players. The width of the shoulders of athletes of all groups is approximately the same, but again, the widest ones are the basketball players, and then the volleyball and handball players. Also, the swing of the arms is the greatest among basketball players, even exceeding the length of their bodies. In volleyball and handball players, the span of the arms practically corresponds to the length of the body. The length of the upper limb in basketball players is the greatest, significantly exceeding the length of the arms of volleyball and handball players, in whom this indicator is approximately equal. The girth

of the shoulder at rest and the girth of the forearm, the largest in basketball players, in volleyball players and handball players - are practically similar results. In all three groups of athletes, the average shoulder length exceeds the length of the forearm. The greatest values of the length and width of the hand were found in basketball players, then in handball players, and the smallest in volleyball players. In female athletes of all three groups, the values of the width of the pelvis are less than the generally accepted, normative, for this age group, equal to 28 - 29 cm [2, p. 36-39; 7, p. 47-54; 12, p. 22-28]. The ratio of the available shoulder width to the width of the pelvis testifies to the masculine type of figure of athletes - with wide shoulders and a narrow pelvis [2, p. 36-39; 7, p. 47-54; 12, p. 22-28]. After receiving the anthropometric indicators necessary for the study and their analysis, we carried out mathematical recalculations of six morpho functional index values used in our study: body mass index; Solovyov index; sexual dimorphism index; arm length index; shoulder width index; brachial index [1; 2, p. 36-39; 7, p. 47-54; 12, p. 22-28]. The obtained results of morpho functional index values are presented in the table 2, at $p < 0.05$.

Indicator name	Basketball players (n = 23)	Volleyball players (n = 25)	Handball players (n = 24)
Soloviev index (SI), cm	15.77 ± 1.13	15.12 ± 0.96	14.33 ± 0.54
Arm length index (ALI)	42.71 ± 0.16	42.01 ± 0.33	41.97 ± 0.69
Shoulder Width Index (ShWI)	19.30 ± 0.44	20.39 ± 0.41	20.66 ± 0.49
Brachial Index (Bri)	1.36 ± 0.17	1.36 ± 0.07	1,34 ± 0.18
Body mass index (BMI), kg/cm ²	22.01 ± 0.97	22.94 ± 0.67	24.61 ± 0.73
Sexual dimorphism index (SDI)	84.61 ± 0.13	82.46 ± 0.21	82.81 ± 0.22

Table 2: Morphofunctional indicators in female athletes of the studied groups.

The analysis of the obtained morpho functional index values convincingly testifies to the adaptive somatic changes in all three groups of female athletes. So, in particular, the indicators of the Solovyov index, the highest among basketball and volleyball players, exceeding the norm (14 - 15 cm). The result obtained indicates thickening of the tubular bones of the forearm [2, p. 36-39; 7, p. 47-54; 12, p. 22-28]. The values of the arm length index, the highest, again, are among the female basketball players. At the same time, the indicators of this morpho functional index value (less than 45), testify to the brachy morphism of these athletes [1]. The obtained indicators of the index of the width of the shoulders, speak of the dolicomorphism of the studied athletes [2, p. 36-39; 7, p. 47-54; 12, p. 22-28]. The smallest values, albeit within the normal range, are for female basketball players and volleyball players. The obtained indices of the brachial index are practically the same for female basketball and volleyball players. Volleyball players have them a little lower. These results indicate the dominance of the upper part of the shoulder girdle and upper limb (shoulder width + shoulder), over the lower part of the upper limb (forearm and hand) [1]. In handball players, the body mass index, on average in the group, is slightly above the upper limit of the normative indicators, at 24.6 kg/cm² [2, p. 36-39; 7, p. 47-54; 12, p. 22-28]. The indices of the sexual dimorphism index (average for the groups) in female basketball players and volleyball players indicate a significant presence in these female athletes, representatives of the inverse, andromorphic sexual somatotype, in the presence, in each of these groups, of a small number of athletes, with a transitional, mesomorphic sexual somatotype - 3 (13.04%) and 4 (16.00%) female athletes, respectively. In handball players, on average in the group, andromorph values were obtained, but slightly higher than the upper limit of the mesomorphic sexual somatotype, equal to 82.1. This is due to the fact that in this group, there are 9 (37.5%) female athletes with a mesomorphic sexual somatotype. In none of the three surveyed groups, the physiological for women, gynomorphic sexual somatotype was not determined [2, p. 36-39; 7, p. 47-54; 12, p. 22-28].

Conclusion

- The results of the study showed that basketball players are strikingly different in anthropometric parameters (primarily large arm span) and indicators of several morphological and functional index values (Solovyov index, upper limb index, shoulder-width index and brachial index, sexual dimorphism index), depending on their playing role.
- The most important are female basketball players who perform the function of centers, followed by attackers and defenders.
- The revealed anatomical and morpho functional features in the athletes of the studied groups, in our opinion, can be caused both by the selection of female athletes by the coaching team carried out earlier, and by the result of adaptive processes caused by long-term and intense physical loads during the training-competitive period.

Conflict of Interests

The authors note that there is no conflict of interest.

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