

Anatomical and Morphofunctional Features of the Bone Pelvis and Lower Extremities in Female Athletes in A Number of Gaming Sports

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Abstract

The article presents the results and analysis of the study dedicated to the definition of a number of anatomical features and morphofunctional index values of the bone pelvis and lower limbs in athletes engaged in basketball, volleyball and handball. It is reliably determined that basketball players have the highest indicators of index values, compared with volleyball players and handball players.

Keywords: *Sportswomen; Playing Sports; Morphofunctional Index Values; Bone Pelvis; Lower Limb*

Abbreviations

PBI: Pelvic Bones Index; SI: Soloviev Index; IRLLE: The Index of the Relative Length of the Lower Extremities; IRWP: The Index of the Relative Width of the Pelvis; PI: Pelvic Index; BIP: Bone Index Pelvis; TrI: Trochanter Index; BMI: Body Mass Index; ISD: Index of Sexual Dimorphism; HLILL: Hip Length Index for Lower Leg

Introduction

Mass engagement in various sports by 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 [2,3]. When selecting for team sports such as basketball, volleyball and handball, there are also criteria for selection of applicants, among which the morphological features of the upper and lower extremities are of great importance [8,9]. It is common knowledge that female athletes' body length is of prime importance in team sports such as volleyball and handball, and especially basketball. Tall athletes dominate in these sports [4,8,9,10]. The length, girth of the athlete's thigh and lower leg, the length and width of the foot, the jogging right and/or left leg are important in the technique of performing some specific techniques in each of these sports. Also, according to a number of researchers, the relationship between each part of the athlete's body, incl. upper and lower extremities, which stabilize by about 14 - 16 years of age as puberty, growth

and maturation of the bone structures of the skeleton, incl. bone pelvis and extremities [4,11,12,13]. 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 body height, including the lower and upper extremities, is of decisive importance for the role of the sports of an athlete and her place on the field - center, in defense or in attack [5,6,9,14]. In connection with the above, the study of the medical and biological and anatomy-morphofunctional features of the bone pelvis and the belt of the lower limbs in athletes, in these teams, playing sports, is very relevant and in demand, both in sports morphology and in a number of other, related medical-biological disciplines.

Aim of the work

The purpose of this article is to represent the data obtained as a result of a study and their analysis regarding the study of the morphofunctional and anatomical features of the pelvis and the belt of the lower limbs in female athletes engaged in basketball, volleyball and handball.

Material and Methods

To carry out this study, we used the following methods: anthropometry with the determination of body length and body weight; determination of the length of the lower limb, both right and left, the width of the shoulders, the length and girth of each part of the lower limb – the thighs and the legs, length, widths and sizes of the foot, determination of the width of the pelvis (intergreave diameter); determination of the Solovyos index – girth of a beam-crew joint in cm.

A number of additional morphofunctional index values were also determined, such as the foot length index (lower extremities), which was determined as the percentage of the total length of the lower limb to the result obtained at the extent of the body length, in cm - the length of the body sitting); the index of the bones of the pelvis (the sum of three transverse and one longitudinal size of the bone pelvis; the index of maturity of the pelvis bones, according to the method of N.I. Kovtyuk; index ratio of the thigh length to the length of the shin; the trochanter index (three) as the length ratio Bodies in cm to the length of the lower limb; the pelvis index, as the sum of three transverse sizes of the pelvis (intergrab, interghessary and trochanteric size, plus the size of the outer conjugate - everything is in cm); the index of sexual dimorphism, according to the method proposed by J. Tanner (1996), followed by the determination of genital somatotypes in each group of athletes; body mass index - by the classical method; the width index of the shoulders, as the percentage of the shoulder width to the length of the body; body mass index (BMI).

Also additionally studied the external dimensions of the bone pelvis of students who participated in the study were studied. For the regulatory options of the measured indicators of the external dimensions of the bone pellets, their regulatory values were taken for these age groups used in anatomy, morphology, obstetrics and gynecology: distantia trochanterica – transverse outdoor size, defined as the distance between two large hip spit, usually 30-32 cm [2,7,12]; conjugata externa is an external straight size of the bone pelvis, which is determined from the middle of the top edge of the pubic symphysis to the surplus pumper and is usually 20-21 cm [2,7,12]. After obtaining the necessary results of pelvimetry and anthropometry, the mathematical calculation of BPI values was carried out, according to the author's formula N.I. Kovtuk [2,7,12]. In the author's criteria, the values were considered to be 30.0-40.0. Indicators less than 30.0 indicate the incompleteness of the process of formation (ripening) of bone structures of the pelvis understudy or to reduce the ripening process of bones. The cause of this process may be disorders from the endocrine and reproductive systems of the studied, various genesis [2,7,12]. Values above 40.0 indicate the completion of the process of ripening the pelvic bones in the examined women [2,7,12]. We also conducted a literary and critical analysis of available sources of information, both domestic and foreign; the method of mathematical statistics when working with the data obtained from anthropometric indicators and morphofunctional index values.

72 athletes took part in the study, actively engaged in such gaming, teampes of sports, like 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 the activities of these sports - from 4.5 to 10 years. Training frequency - 5-6 times a week, 2 - 2.5 hours. This study was conducted in a number of sports sections and clubs of the Nikolaev and Kherson regions, Ukraine, and St. Petersburg, Russia, subject to absolute voluntariness, as from the athletes themselves, and with the consent and active support of coaching teams.

Result and Discussion

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

Indicator name	Basketball players (n=23)	Volleyball players (n=25)	Handball players (n=24)
Length of the body (standing), cm	$192,77 \pm 1,36$	$179,35 \pm 1,13$	$177,03 \pm 1,11$
Body weight, kg	$82,03 \pm 0,74$	$73,23 \pm 1,08$	$71,54 \pm 1,29$
Shoulder width, cm	$36,43 \pm 1,04$	$35,53 \pm 1,27$	$35,67 \pm 1,14$
Length of the lower limb, cm	$105,37 \pm 1,93$	$102,17 \pm 1,71$	$93,83 \pm 1,86$
Length of the hip, cm	$62,17 \pm 1,14$	$61,87 \pm 1,33$	$56,08 \pm 1,21$
Gripping thigh alone, cm	$52,89 \pm 1,13$	$51,67 \pm 1,88$	$53,86 \pm 1,14$
Shin length, cm	$43,47 \pm 1,66$	$40,47 \pm 1,54$	$37,93 \pm 1,68$
Shin girth, cm	$35,47 \pm 1,09$	$33,67 \pm 1,16$	$34,97 \pm 1,28$
Foot length, cm	$28,57 \pm 1,45$	$29,81 \pm 1,68$	$27,85 \pm 1,54$
Width of the foot, cm	$8,56 \pm 1,37$	$9,47 \pm 1,08$	$8,23 \pm 1,36$

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

Analysis of the results of the resulting anthropometry showed that in terms of the length of the body of the basketball players can be attributed to very high athletes, and volleyball players - to high growth athletes [4,6,7,13]. Basketball players, then volleyball players and handball players also had the greatest body. The width of the shoulders in athletes of all groups is approximately the same, but again, the widespread are basketball players, and then go volleyball players and handball players. The length of the lower limb of basketball players is the largest, exceeding the length of the lower limbs in volleyball players and handball players. In all three groups of athletes, the length of the hinder exceeds the length of the shin, while the smallest value of the hinder-Girth of hips alone and tacit girth The largest basketball player and handball players, volleyball players and handball players - practically similar results. length have handball players, and the greatest length - basketball players, and then - volleyball players. In all three groups of athletes, the average hip length exceeds the length of the shin. The largest lengths of the length and width of the foot - volleyball players, then - basketball players, the smallest - from the handball players. In female athletes of all three groups, the values of the pelvis width, less generally accepted, regulatory for this age group, equal to 28-29 cm [2,7,12]. The ratio of the existing widths of the shoulders and the width of the pelvis is indicated about the masculine type of figure of athletes - with broad shoulders and a narrow pelvis [2,7,12].

Also, we carried out a pelvimetry carried out according to the classical technique using the Martin Circle. The results of the measurements of 3 transverse and 2 longitudinal, outdoor sizes of the bone pelvis of athletes are presented in table 2, at $p < 0,05$:

Indicator name	Basketball players (n=23)	Volleyball players (n=25)	Handball players (n=24)
D. spinarum, cm	25,01±0,24	24,81±0,27	24,37±0,33
D. cristarum, cm	27,14±0,67	27,56±0,38	27,51±0,11
D. trochanterica, cm	31,35±0,74	31,22±0,61	31,17±0,88
C. externa, cm	20,03±0,74	19,87±0,21	19,31±0,77
C. vera, cm	10,89±0,67	10,45±0,49	10,23±0,66

Table 2: Results of pelvimetry in the studied groups of female athletes.

Analysis of the obtained results of pelvimetry showed that athletes of all three surveyed groups have clinical manifestations of the anatomically narrow pelvis. This is convincingly evidenced by all transverse and longitudinal dimensions of the bone pelvis reduced compared to the standard. So, for example, d. spinarum is normal (for this age group) must correspond 25 - 26 cm; d. cristarum - 28-29 cm; d. trochanterica - 30 - 32 cm; c. externa - 20-21 cm; c. vera - 11 cm [2,7,12]. After receiving the anthropometric indicators necessary for this study and their analysis, we carried out mathematical recalculations of six morphofunctional index values used in conducting our study: body mass index; Solovyov index; index of sexual dimorphism; index of the length of the lower extremities [1]; index pelvis; the index of the relative width of the pelvis; Bone index pelvis; trochanter index; index value of the thigh length, cm / lower leg length, in cm. The results of nine morphofunctional index values are presented in table 3, at $p < 0,05$:

Indicator name	Basketball players (n = 23)	Volleyball players (n = 25)	Handball players (n = 24)
Solovyov index, cm	15,77 ± 1,13	15,12 ± 0,96	14,33 ± 0,54
The index of the relative length of the lower extremities	55,27 ± 0,41	57,56 ± 0,53	53,72 ± 0,29
The index of the relative width of the pelvis	14,33 ± 0,18	15,48 ± 0,47	15,52 ± 0,34
Pelvic index	105,92 ± 0,23	104,93 ± 0,27	104,45 ± 0,41
Bone index pelvis	43,14 ± 0,93	42,68 ± 0,33	41,68 ± 0,33
Trochanter index	1,81 ± 1,03	1,74 ± 0,66	1,86 ± 0,53
Body Mass Index, kg / cm ²	22,01 ± 0,97	22,94 ± 0,67	24.61 ± 0,73
Index of sexual dimorphism	84,61 ± 0,13	82,46 ± 0,21	82,81 ± 0,22
Hip length index for lower leg	1,41 ± 0,08	1,52 ± 0,12	1,45 ± 0,41

Table 3: Morphofunctional indicators in female athletes of the studied groups.

Analysis of the resulting morphofunctional index values, convincingly testifies to the existing, in all three groups of athlete's adaptive somatic changes. So, in particular, the indicators of the Solovyov index, the largest basketball players and volleyball players exceeding the values of the norm (14-15 cm). The result obtained testifies to the thickening of the tubular bones of the limbs [2,7,12]. The smallest values, although within the limits of the norm, was determined by basketball players and volleyball players. In handball players, the body mass index on average for a group is slightly higher than the upper boundary of the regulatory indicators, in 24.5 kg / cm² [2,7,12]. The pelvic index values indicate that the basins of athletes, despite the single cases of the normal sizes of the pelvis, less regulatory indicators in 107-109. Thus, in all three studied groups, the IT values indicate the presence of anatomically narrow pelvis (out) [2,7]. The values of the index of the relative pelvis width is its average value for all three groups, less permissible, from 16.0 to 17.9 [2,7]. The indicators of the trochanter index, in the mean values in groups, reliably indicate that the handball player defines the disestive type of the Constitution,

and volleyball players and basketball players are a pathological type of constitutional development [2,7]. Significantly, the data obtained indicate wallopyelium - a narrow pelvis, while the value of this morphofunctional index value, the smallest of basketball players. Thus, if they have very high growth, wide shoulders, a narrow pelvis and long lower extremities, it can be argued whether they have a giant type of physique [2,7]. Handball players and volleyball players, a biotoid type of physique [2,7]. Indicators of medium-range values of the relative length of the lower limb are as follows: Basketball players - metriscelia (from 55.0 to 56.9); Volleyball players - macroscelia - 57.0 and higher (long leg); Handball players - brachioscelia (short foot) - up to 54.9 [4,5,14]. These indicators are confirmed by indicators of index relationships of the thigh length to the length of the shin [4,5,14]. Indicators of the index of sexual dimorphism (medium in groups) in basketball players and volleyball players indicate a reliable presence in these athletes - representatives of invertive, andromorphic sexatype, if there is a small number of athletes with transition, mesomorphic sex - 3 (13, 04%) and 4 (16.00%) athletes, respectively. In handball players, an average of a group, and the values of andromorphism were obtained, but a slightly large upper boundary of the mesomorphic floor somatotype, equal to 82.1. This is due to the fact that in this group, there are 9 (37.5%) athletes with mesomorphic sexomatype. None of the three surveyed groups was defined, physiological for women, gynechomorphic sexatype [2,7,12].

Conclusion

1. The results of the study showed that basketball players vaporly vary by anthropometric parameters (primarily along the length of the lower limb and its components) and in terms of the number of morpho functional index values (Solovyov index, the relative length index of the lower limb, the index of the relative pelvis width, the trochanter index, index of sexual dimorphism), depending on their gaming role.
2. More moderate pelvis values and lower extremities, have volleyball players, and then - handball players.
3. The identified anatomical and morpho functional features of the athletes of the studied groups, in our opinion, may be due to the coaching team held earlier by the selection of athletes and the result of adaptive processes caused by long (perennial) and intensive physical exertion.

The author notes the absence of any conflicts of interest.

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