POSITION-SPECIFIC MORPHOLOGICAL CHARACTERISTICS OF FEMALE YOUTH HANDBALL PLAYERS

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Abstract. *The aim* of our study was to determine the morphological characteristics of under-17 (U17) and under-19 (U19) female handball players, depending on their playing position, namely, the offense (first line) and defense (second line). Materials and methods. 37 female junior handball players of the members of the national handball team of Ukraine were involved in the research. The body length was measured in a standing position using a telescopic mechanical stadiometer. The body composition was determined by a Tanita-BC-418MA 8-electrode bioimpedance analyzer.

The results. Players of both the first and second lines of different age groups did not have statistically significant differences in terms of basic anthropometric indicators. However, the first-line players in the U19 group, had lower relative fat content, and greater lean mass and water content than did players in the U17 group. These differences were mainly due to differences in the fat-free and predicted muscle mass of the lower limbs. In the second-line players of different age groups, differences in the component composition of the body were more pronounced. The U19 athletes had a statistically significantly lower fat content in their entire body, but the water content, lean mass and its index were higher than such U17 handball players. Segment analysis showed that while the relative fat content in the upper and lower limbs of U19 athletes was lower than in the U17 group, but the U19 group had higher lean and predicted muscle masses. Knowledge of positional differences in body composition can expand the possibilities for developing specialized training programs for handball players of various age groups, including cadets and juniors.

Keywords: handball, playing role, morphological characteristics, component composition of the body.

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ОСОБЛИВОСТІ МОРФОЛОГІЧНИХ ХАРАКТЕРИСТИК ГАНДБОЛІСТОК РІЗНИХ ВІКОВИХ ГРУП З УРАХУВАННЯМ ЇХ ТАКТИЧНИХ РОЛЕЙ

Анотація. *Метою* нашого дослідження було визначення морфологічних характеристик гандболісток віком до 17 років (U17) та до 19 років (U19) залежно від їхньої ігрової позиції, а саме: напад (перша лінія) і захист (друга лінія). Матеріали і *методи.* У дослідженні взяли участь 37 гандболісток-юніорів членів національної збірної команди України з гандболу. Довжину тіла вимірювали в положенні стоячи за допомогою телескопічного механічного ростоміра. Компонентний склад тіла визначали 8-електродним біоімпедансним аналізатором "Tanita-BC-418MA".

Результати дослідження. Гравці як першої, так і другої ліній різних вікових груп за базовими антропометричними показниками не мали статично значущих відмінностей. Проте у гравців першої лінії групи U19 відносний вміст жиру був меншим, а знежирена маса та відсотковий вміст води більшими, ніж у групі U17. Ці відмінності спостерігались переважно через різницю у знежиреній і передбачуваній м'язовій масі нижніх кінцівок. У гравців другої лінії різних вікових груп відмінності компонентного складу тіла були більш вираженими. У спортсменок U19 у всьому тілі статистично вірогідно меншим був вміст жиру, натомість вміст води, знежирена маса та її індекс були більшими за такі в гандболісток U17. Сегментарний аналіз показав, що у спортсменок U19 у верхніх і нижніх кінцівках відносний вміст жиру був меншим, а знежирена й передбачувана м'язова маси перевищувала відповідні значення групи U17.

Висновки. Знання про позиційні розбіжності компонентного складу тіла може розширити можливості розроблення спеціалізованих тренувальних програм для гандболістів різних вікових груп, зокрема кадетів і юніорів.

Ключові слова: гандбол, ігрове амплуа, морфологічні характеристики, компонентний склад тіла.

Introduction. Today, international sports are becoming more and more competitive; the competition is tougher and starts younger than ever. In these circumstances, the performance of junior athletes is evaluated mostly on the grounds of physical fitness and morphological characteristics that give an idea about the athletes' skill and allow coacher to predict their potential and future professional growth [5; 15; 16; 19]. Handball is a dynamic and contact sport in which players, depending on their specialization, perform various tasks: running/sprinting, jumping, throwing, hitting, pushing and blocking. With such a variety of playing tasks, it is crucial that athletes possess not only good skills and tactical training, but also well-developed physical condition: speed, coordination, strength and endurance [6]. In the modern standards for handball players, a well-developed musculoskeletal system, as seen in athletes' anthropometric and morphological characteristics, plays a significant role in the performance of specific tasks during actual games [1; 17; 18]. For instance, arm length and span are important for performing and blocking throws [3], whereas strength and relatively high muscle mass are prerequisite for successful individual actions against an opposing player, since they bring the benefit of endurance under major static and dynamic pressure [6]. In contrast, excessive fat tissue amounts to additional mass, which has to be carried around while performing sports activities; this reduces athletes' performance and adds to their metabolic costs. Therefore, body length and mass, their proportion, and body composition are important indicators that can be used as criteria in selecting young athletes to play in different court positions [1; 21].

In defense, for instance, the most crucial indicators are the anthropometric measurements and strength, because defensive players are in constant contact with the opposite team fighting for the position or the ball [2]. Morphological characteristics are no less crucial for goalkeepers, as the specifics of their play impart certain requirements to their build and anthropometric measurements. For offensive players, anthropometric indicators are not so crucial; accordingly, these players have shorter stature, lower body weight and smaller body volume. However, they must also have low fat content, since their playing role calls for immediate response to the changing situation on the playing court and high-speed movement – qualities that are determined by the muscle mass and physical conditioning of athletes [16; 17].

Despite the importance of anthropometric and morpho-logical characteristics in handball players' performance, there is not enough information regarding the specific characteristics of junior handball players. There are no normative standards for such players, and determining such standards is not an easy task.

Thus, **the aim of our study** was to determine the morphological characteristics of female handball players on under-17 (U17) and under-19 (U19) teams, depending on their playing position, namely, in offense (first line) and defense (second line).

Material and methods. *Participants.* The study involved 37 female junior handball players on the national handball team of Ukraine; 22 players were 15-16 years old (U17 group), and 15 players were 17–19 years old (U19). Data collection and processing were carried out in accordance with the Helsinki Declaration of the World Medical Association on the ethical principles of medical research with the participation of a person as an object of study. All the participants were informed about the measuring procedures and signed a written consent form for this specific study. For underage players, the consent forms were signed by their parents.

Procedures. The standing body length was measured using a telescopic mechanical stadiometer (Seca 222, Germany). The body composition was determined by an 8-electrode bioimpedance analyzer (Tanita-BC-418MA, Japan), which was used to identify the following parameters: body mass, body mass index (BMI), percentage and mass of fat tissue, lean body mass, and total water content. Then each upper and lower limb as well as the torso was evaluated separately in terms of percentage and mass of fat tissue, lean mass, and predicted muscle mass. Finally, for the whole body we additionally calculated fat mass index, fat-free mass index, and relative water content.

The measurements were carried out outside the participants' menstrual periods. Within 24 hours before measurement, the participants did not have intensive physical training and did not use any medications or pharmaceutical products that could interfere with their water balance. In order to avoid procedural errors, the measurements were taken by the same person at the same time of the day – between 7 and 8 a.m., before breakfast. Prior to measuring the participants had not taken food or water for 6–8 hours.

Statistical analyses. The results were processed using the Statistica 6.0 analytics software package. The Kolmogorov – Smirnov test was performed to evaluate the normality of the descriptive statistics. To evaluate the normality of the data, Levene's test was used. The Mann – Whitney U test was used to determine statistically significant differences between groups. The data were represented in a graph showing the median-, and 1st and 3rd quartiles.

Results. The average age of the athletes was 15,5 years for the U17 team and 18 years for the U19 team. As expected, not only the average age, but also the average number of years spent in sports significantly differed between the U17 and U19 groups – 6 years for U17 team players and 8 years for U19 team players (Table 1).

The analysis of basic anthropometric data showed that the average height of U17 athletes was 175,3 ± 5,2 cm, whereas the average height of U19 team members was slightly lower – 174,3 ± 6,5 cm; however, this difference was statistically insignificant (Table 1).

The U17 and U19 players also had no significant differences in body mass or BMI (Table 1). Nevertheless, U19 athletes had smaller absolute and relative fat mass – and, conversely, greater lean mass and water content (both absolute and relative) – in the whole body, compared to U17 athletes.

The segment analysis of body composition showed that U19 athletes had lower fat content and greater lean mass and predicted muscle mass in the upper and lower limbs than did U17 athletes (Table 1). At the same time, the torso measurements significantly differed between teams only in terms of relative body fat.

In analyzing the data on the component composition of the body of female handball players of different age groups with regard to their tactical roles, we found that first-line

Table 1 – Body component composition of female junior handball players by age group

Indicators	Age groups						p
	U17 (n = 22)			U19 (n = 15)			
	Me	Q1	Q3	Me	Q1	Q3	
Age (years)	15,5	15,0	16,0	18,0	18,0	19,0	0,0000
Years in sports	6,0	5,0	7,0	8,0	7,0	9,0	0,0002
Height (cm)	176,0	173,0	177,0	174,0	169,0	180,0	0,4720
Weight (kg)	69,6	60,7	76,1	68,9	60,4	78,4	0,8666
BMI (kg/m^2)	22,6	20,4	23,7	22,3	21,1	24,1	0,7025
Fat (%)	28,2	24,0	30,6	19,8	19,0	24,1	0,0006
Fat mass (kg)	20,2	14,3	22,1	13,1	11,8	18,9	0,0302
FMI (kg/m^2)	6,5	4,5	7,1	4,5	4,1	6,0	0,0523
FFM (kg)	49,4	46,1	50,8	52,2	49,2	58,5	0,0114
FFMI (kg/m^2)	16,1	15,6	16,4	18,1	17,0	18,7	0,0001
TBW (kg)	36,2	33,6	37,2	38,2	36,0	42,8	0,0094
WC (%)	52,6	50,8	55,6	58,7	55,6	59,4	0,0005
Segment analysis of body composition							
Right leg							
Fat (%)	33,3	30,1	35,0	25,2	23,3	28,8	0,0002
Fat mass (kg)	4,2	3,2	4,8	3,2	2,7	4,0	0,0385
FFM (kg)	8,3	7,9	8,7	9,3	8,6	9,9	0,0018
PMM (kg)	7,8	7,4	8,2	8,8	8,1	9,3	0,0021
Left leg							
Fat (%)	33,2	30,7	35,5	26,0	24,1	27,9	0,0000
Fat mass (kg)	4,1	3,2	4,7	3,1	2,8	3,9	0,0699
FFM (kg)	8,1	7,6	8,4	9,4	8,5	10,2	0,0000
PMM (kg)	7,7	7,2	7,9	8,8	8,0	9,6	0,0000
Right arm							
Fat (%)	33,3	25,5	35,3	15,9	14,5	20,1	0,0000
Fat mass (kg)	1,1	0,7	1,3	0,6	0,4	0,8	0,0008
FFM (kg)	2,2	2,1	2,3	2,9	2,5	3,1	0,0000
PMM (kg)	2,1	1,9	2,2	2,7	2,4	2,9	0,0000
Left arm							
Fat (%)	34,4	26,2	38,5	16,2	14,6	22,1	0,0000
Fat mass (kg)	1,2	0,7	1,5	0,6	0,4	0,9	0,0011
FFM (kg)	2,2	2,1	2,4	2,8	2,5	3,2	0,0000
PMM (kg)	2,1	2,0	2,3	2,6	2,3	3,0	0,0000
Torso							
Fat (%)	23,0	18,7	28,1	16,8	16,3	23,6	0,0235
Fat mass (kg)	8,8	6,3	11,2	6,0	5,2	9,6	0,0606
FFM (kg)	28,2	26,3	29,6	28,5	26,8	32,2	0,2759
PMM (kg)	27,0	25,1	28,3	27,2	25,6	30,8	0,2759

Note: Me – median, Q1 – 1st quartile, and Q3 – 3rd quartile; BMI – body mass index; FMI – fat mass index; FFM – fat free mass; FFMI – fat free mass index; TBW – total body water; WC – water content; PMM – predicted muscle mass. Differences between groups determined by Mann – Whitney U test, p < 0,05.

players of both age groups did not differ significantly in basic anthropometric indicators (height, body mass, BMI; see Table 2).

However, U19 athletes had 11,7% (p = 0,0349) lower relative fat content, 8,0% (p = 0,1013) greater lean mass and 3,3% (p = 0,0349) higher water content, compared to U17 athletes (Table 2). As we discovered in the process of segment analysis, such differences were mostly due to the different lean mass and predicted muscle mass of the lower limbs. Looking at the upper-limb measurements, the only statistically significant difference we found was in the relative fat content. Specifically, U19 athletes had a lower percentage of fat mass by 31,0% (p = 0,0139) and 33,6% (p = 0,0349) in the right and left arms, respectively, compared to the younger

Table 2 – Body component composition of female junior handball players by playing position and age group

Indicators	Playing position groups					
	First-line players			Second-line players		
	U17	U19	p	U17	U19	p
1	2	3	4	5	6	7
Height (cm)	171,0 (170,0; 174,0)	170,0 (169,0; 172,0)	0,4452	177,0 (175,0; 178,0)	178,0 (175,0; 183,0)	0,6398
Weight (kg)	59,1 (52,9; 66,6)	60,7 (58,4; 63,8)	0,7307	70,7 (68,0; 78,0)	76,4 (70,8; 78,4)	0,3175
BMI (kg/m^2)	20,4 (18,1; 23,4)	21,0 (19,7; 22,3)	0,5338	22,9 (22,0; 24,3)	23,6 (22,2; 25,2)	0,4114
Fat (%)	21,4 (20,7; 24,1)	18,9 (18,0; 19,3)	0,0349	29,5 (26,5; 32,0)	23,5 (20,8; 27,1)	0,0009
Fat mass (kg)	12,5 (11,1; 14,6)	11,4 (10,3; 12,1)	0,1806	21,1 (18,7; 24,5)	18,0 (15,5; 19,8)	0,0475
FMI (kg/m^2)	4,2 (3,8; 5,6)	3,9 (3,5; 4,2)	0,3659	6,9 (5,8; 7,4)	5,6 (4,6; 6,9)	0,0955
FFM (kg)	46,1 (42,5; 48,1)	49,8 (47,5; 51,7)	0,1013	49,8 (48,3; 53,4)	57,7 (55,8; 59,5)	0,0054
FMI (kg/m^2)	16,1 (14,7; 16,2)	17,2 (16,1; 18,1)	0,1357	16,1 (15,7; 16,7)	18,2 (18,0; 18,8)	0,0001
TBW (kg)	33,7 (31,1; 35,2)	36,5 (34,8; 37,8)	0,0734	36,5 (35,3; 39,1)	42,3 (40,9; 43,6)	0,0054
WC (%)	57,5 (55,5; 58,0)	59,4 (59,1; 60,1)	0,0349	51,6 (49,9; 53,8)	56,0 (53,3; 58,0)	0,0007
Segment analysis of body composition						
Right leg						
Fat (%)	27,1 (25,1; 31,7)	23,8 (23,0; 24,9)	0,0512	34,0 (32,3; 36,7)	28,7 (25,2; 30,9)	0,0004
Fat mass (kg)	3,0 (2,7; 3,4)	2,6 (2,4; 3,0)	0,2342	4,5 (3,9; 4,9)	3,8 (3,3; 4,2)	0,0731
FFM (kg)	7,8 (7,3; 8,2)	8,7 (8,2; 8,9)	0,0139	8,6 (8,0; 9,0)	9,8 (9,5; 10,4)	0,0027
PMM (kg)	7,4 (6,9; 7,8)	8,2 (7,8; 8,4)	0,0221	8,1 (7,6; 8,5)	9,2 (9,0; 9,8)	0,0034
Left leg						
Fat (%)	27,6 (26,2; 31,4)	23,6 (21,3; 24,7)	0,0221	34,1 (32,2; 36,7)	27,8 (26,3; 30,7)	0,0000
Fat mass (kg)	2,9 (2,7; 3,4)	2,7 (2,2; 3,0)	0,2948	4,3 (3,9; 4,8)	3,8 (3,7; 4,3)	0,1552
FFM (kg)	7,6 (7,1; 8,1)	8,7 (8,3; 8,9)	0,0046	8,2 (7,7; 8,7)	10,1 (9,6; 10,6)	0,0002
PMM (kg)	7,2 (6,7; 7,7)	8,2 (7,8; 8,4)	0,0046	7,7 (7,3; 8,2)	9,6 (9,1; 10,0)	0,0002
Right arm						
Fat (%)	21,4 (15,3; 25,8)	14,2 (13,1; 14,9)	0,0139	34,3 (31,9; 36,5)	19,9 (15,9; 21,9)	0,0000
Fat mass (kg)	0,6 (0,5; 0,8)	0,4 (0,4; 0,5)	0,0512	1,1 (1,0; 1,3)	0,8 (0,6; 0,9)	0,0004
FFM (kg)	2,2 (1,9; 2,4)	2,6 (2,4; 2,6)	0,0512	2,2 (2,1; 2,3)	3,1 (2,9; 3,3)	0,0000
PMM (kg)	2,0 (1,7; 2,2)	2,4 (2,2; 2,5)	0,0512	2,1 (1,9; 2,2)	2,9 (2,7; 3,0)	0,0000
Left arm						
Fat (%)	21,0 (16,9; 27,6)	14,5 (14,4; 14.9)	0,0349	36,2 (32,1; 40,0)	20,2 (16,8; 23,8)	0,0000

Continuation of Table 2

1	2	3	4	5	6	7
Fat mass (kg)	0,6 (0,5; 0,8)	0,4 (0,4; 0,5)	0,0512	1,3 (1,0; 1,5)	0,8 (0,7; 0,9)	0,0004
FFM (kg)	2,2 (1,9; 2,5)	2,5 (2,3; 2,8)	0,0512	2,3 (2,2; 2,4)	3,1 (3,0; 3,2)	0,0000
PMM (kg)	2,0 (1,8; 2,3)	2,3 (2,1; 2,6)	0,0512	2,1 (2,0; 2,3)	2,9 (2,8; 3,0)	0,0000
Torso						
Fat (%)	18,7 (13,3; 19,3)	16,2 (15,0; 16,4)	0,2342	24,1 (21,3; 28,6)	20,9 (17,3; 24,8)	0,0955
Fat mass (kg)	6,0 (3,9; 6,9)	5,1 (5,0; 5,4)	0,2342	9,3 (8,7; 11,4)	8,5 (7,2; 9,7)	0,1737
FFM (kg)	26,3 (25,4; 26,9)	27,3 (26,3; 28,5)	0,1806	28,6 (27,9; 31,4)	31,6 (30,7; 32,2)	0,1552
PMM (kg)	25,1 (24,3; 25,7)	26,1 (25,2; 27,2)	0,1806	27,3 (26,7; 30,0)	30,2 (29,3; 30,8)	0,1552

Note: Me – median; Q1 – 1st quartile, and Q3 – 3rd quartile; BMI – body mass index; FMI – fat mass index; FFM – fat free mass; FFMI – fat free mass index; TBW – total body water; WC – water content; PMM – predicted muscle mass. Differences between groups determined by Mann – Whitney U test, p < 0,05.

team. We did not observe any significant differences between teams in torso measurements (Table 2).

U17 and U19 second-line players also exhibited no significantly different anthropometric indicators; however, the component composition of the body differed more markedly (Table 2). In the whole body, the older handball players had significantly smaller relative (by 20,3%; p = 0,0009) and absolute (by 14,7%; p = 0,0457) fat content. At the same time, the older athletes had an edge over the younger ones in absolute and relative water content (15,9%; p = 0,0054, and 8,5%; p = 0,0007 more, respectively), as well as in lean mass (15,9% more; p = 0,0054) and its index (13,0% bigger; p = 0,0001). The analysis of the component composition of body segments demonstrated that the U19 group had lower relative fat content in the lower limbs – by 15,5% (p = 0,0004) in the right leg and by 18,5% (p = 0,00001) in the left leg (Table 2). As far as the lean mass and predicted muscle mass, the older team's indicators were greater than those of the younger team – by 14,0% (p = 0,0027) and 13,6% (p = 0,0034), respectively, in the right leg; and by 23,2% (p = 0,0002) and 24,7% (p = 0,0002), respectively, in the left leg. In the upper limbs, the lean mass and predicted muscle mass of the older players were also greater, than those on the U17 players – by 40,9% (p = 0,00001) and 38,1% (p = 0,00001) in the right arm; and by 34,8% (p = 0,00001) and 38,1% (p = 0,00001) in the left one (Table 2). In these body segments, U19 athletes had lower relative and absolute fat content by 42,0% (p = 0,00001) and 27,3% (p = 0,0004) in the right arm, and 44,2% (p = 0,00001) and 38,5% (p = 0,0004) in the left one, respectively. Similarly, in the torso, the lean and muscle mass of the older group was greater, and the fat mass (both relative and absolute) smaller than the respective indicators of the younger group; however, these differences were not of statistically significant (Table 2).

Discussion. Despite a strong modern tendency towards versatility of players in a team, their specialization is still a priority. The differentiation between offensive and defensive playing roles leads to the rational placement of athletes on the playing court and to the best possible use of their potential. In this context, anthropometric and morphological characteristics can be crucial in determining a playing role for each athlete, as athletes with greater body length, total body mass and lean mass will have an advantage when fighting for position.

According to the data from various published studies, anthropometric measurements of European female junior national handball players differ between countries, but in all cases, they are lower than those of Ukrainian athletes. For instance, Garcia et al. [8] reported that Spanish female handball players under 17 years of age were on average 168,7 ± 6,5 cm tall, and players under 19 on average 169,9 ± 4,5 cm tall. Saeterbakken et al. [22] found that female handball players on the national team of Norway, aged 16,6 ± 3,1 years, were on average 169 ± 7,3 cm tall. The average height of the Brazilian national team, aged 18,0 ± 2,1 years, was 170,2 ± 6,2 cm [16]; the average height of the players in the Italian national championship, aged 17,3 ± 2,25 years, was 166,0 ± 5,1 cm [17].

As shown in our study, there was no significant difference between handball players of the two age groups in terms of BMI, but the lean mass was greater in the older group. In our opinion, this difference can be attributed to the fact that the players on the U19 team have already completed the phases of active growth and puberty. In addition, as athletes advance, they undergo more intense strength training within their physical conditioning program; this affects the component composition of the body and leads to the growth of muscle mass, as other authors also emphasize [7; 21]. It has to be noted that the Spanish female cadet players of the same age groups had practically the same body weight (70,4 ± 12,1 and 69,3 ± 9,6 kg) and slightly higher BMI (25,7 ± 9,7 and 24,0 ± 2,9 kg/m^2), compared to the Ukrainian handball players [8]. However, 18-year-old female players of the Brazilian national team had an average body weight of 64,9 ± 7,1 kg, and Norwegian female handball players 63,0 ± 5,9 kg [16; 22]. The authors of the latter studies did not include data on

the athletes' BMI, fat content, lean mass and their indexes. The female athletes of the Italian national championship aged 15–19 had a body mass of 64,4 ± 10,47 kg, BMI 23,3 ± 4,01 kg/m², relative fat content 28,6 ± 4,01%, and lean mass 42,9 ± 5,3 kg [17].

The segment analysis of body composition demonstrated that U19 female handball players had lower fat content and higher lean mass and predicted muscle mass in both upper and lower limbs, compared to U17 players. Such differences may be connected to the fact that in handball the morphological and anthropometric characteristics of the upper limbs are among the key factors in seizing the ball, performing throws, and blocking the opposing team's players [5; 17]. Meanwhile, sufficient muscle mass and strength of the lower limbs are the basis of good sprinter qualities while moving around the court, and of high throwing speed, which depends on the ability to apply strength in the legs more than in the arms [20]. The ball is the same in size and weight for both age groups; however, U19 players not only are chronologically older, but also have more years of experience in sports and developmental maturity, which allows them to have formed a stable anthropometric profile. Other scholars have also noted significant differences in the component composition of upper and lower limbs of female handball players, for example, in the Italian national championship. However, those studies involved groups of elite and sub-elite players, aged 26,4 ± 5,77 and 17,3 ± 2,25 years, respectively [17].

Anthropometric and morphological profiles of female handball players are important for them to be effective on the playing court, in their specific positions. Studying the movements of athletes around the court, we get information on how they perform various tasks depending on their playing roles and the dynamics of teamplay (whether they are attacking or defending). Since the main task of center back players is organizing attacks, we regard them as first-line, together with wing players. Incidentally, other scholars who study the build of young handball players have also noted the similar anthropometric characteristics of wing players and center backs [4], although the modern handball model presupposes that the latter should share qualities with left and right backcourt players. Since studies confirm that in order to be successful in their play, pivots, left and right backcourts and goalkeepers should have similar anthropometric profiles [23], we classified these playing roles as second-line.

When studying the component composition of the bodies of first-line players, we observed the main difference between U17 and U19 age groups in the lean mass of lower limbs. In our opinion, such results can be explained by the fact that the older athletes have more years of experience in sports; during which they have developed the specific qualities needed for their tasks in play. Because first-line players need to move fast and cover the greatest total distance (in sprints) during games [14], it is plausible that U19 players are ahead of the younger team in the lean mass of lower limbs.

The second-line players did not demonstrate significant differences between the age groups in their anthropometric indicators, but disparities in the component composition of the body and its segments were more noticeable than in the case with the first line. Our previous research showed that in adult players of the women's national handball team of Ukraine, female athletes of the 2nd line had a greater lean mass in all body segments, compared to 1st-line the players [9].

Comparing our observations with those of other scholars, we noticed that they were in accordance with those of Karcher et al. [14], who observed that second-line players, pivots in particular, spend a greater part of playtime in power struggle with the opposite team, while left and right backcourts play much more intensively than wings. Therefore, it is important that these players have greater lean and muscle mass, as such parameters are key to the strength, that is necessary in their playing positions. According to other studies, athletes with greater muscle mass will have an advantage in handball [10], and it is advantageous for second-line players and goalkeepers to be large in body size and volume [23]. It should be mentioned, however, that these studies looked at male teams.

In other published studies, the authors also paid attention to age differences with regard to morphological characteristics of players in different playing roles. For instance, Rousanoglou et al. [21] observed that junior handball players of the Greek national team (both first- and second-line) demonstrated significant differences between age groups U20, U18, and U16 in such indicators as body mass, height, time of 5-m sprint, and other aspects of physical conditioning. The authors attribute such differences to the maturation process and the progressive increase of intensiveness in training. Nicolaidis et al. [19] compared morphological and physiological characteristics of adult and teenage handball players of different playing roles; the authors emphasized that differences were mainly related to age. Other scholars agree that junior handball players will inevitably experience changes in the abovementioned characteristics, the reasons being their completion of puberty, the growth of muscle tissue, as well as intensified strength training for older athletes [1; 11; 12].

Conclusions. While training handball players in skills and tactics, one needs to take into account their position on the playing court, as well as the typical tasks that they carry out during games. Thus, to be able to grow in their sportsmanship at every age, athletes need to have reached a certain level of physical development, and have particular anthropological and morphological characteristics, in accordance with their playing roles. The information on positional differences of the component composition of the body can expand possibilities for the development of specialized training programs for handball players of different age groups, including cadets and juniors.

Prospects for further research. Further research could focus on establishing the relationship between body composition and physical performance indicators in players of different age groups and playing positions.

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