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## ANTHROPOMETRIC DATA OF THE PROFESSIONAL FOOTBALL PLAYERS OF BUKOVYNA

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**Abstract.** Since such a team game as football is a high-intensity sport that requires athletes to be active for 90 minutes, covering distances of up to 7 miles during a game on the field, according to Dr. Howard Libeskind, an orthopedist for the U.S. national soccer team. In our opinion, although many methods are currently available to assess the anatomical parameters of the body, there is no criterion methodology specifically defined for football players. Any coach wants to achieve the maximum possible result, especially in football. So, for the purpose to establish the anatomical parameters of the "University" football masters team of Ukraine, a study was conducted on 32 respondents aged from 16 to 18 years. The main group was made up of 16 players of the "University" football team of masters of sports of Ukraine. The control group consisted of 16 young boys that are studying at a higher education institution in Bukovyna (Bukovyna State Medical University). The representatives of the main group were practically healthy (no history of congenital or chronic pathology was noted), masters of sports of Ukraine, who systematically trained intensively and participated in championships of Ukraine among higher educational institutions, under the leadership of the team coach. Training took place 3-4 times a week, 1.5 hours on average. The subjects of the control group were also practically healthy young men who were loaded with hours of physical education, according to the programs of their specialty, and additionally did not play sports.

Anthropometric examination included determination of total (body length and weight) parameters and partial (length of upper and lower limbs, thigh length, chest circumference during inhalation, exhalation and at rest, pelvic circumference, thigh circumference in the upper third, in the middle and lower third). Statistical analysis of the obtained data was carried out using the licensed program RStudio. A paired t-test (t-test of paired samples) was conducted to compare the indicators of the studied main and control groups. According to the results, the length of the right upper limbs is on average  $78.50 \pm 2.02$  cm, the left -  $78.75 \pm 2.02$  cm. The length of the right lower limbs is  $92.63 \pm 2.06$  cm, the left -  $92.44 \pm 2.06$  cm. The average length of the right and left thigh is  $52.25 \pm 2.04$  cm. The circumference of the thigh in the upper third on the right is  $55.31 \pm 2.03$  cm, on the left -  $54.18 \pm 2.03$  cm, in the middle third on the right thigh, the indicator was  $49.13 \pm 2.01$  cm, on the left -  $52.44 \pm 2.01$  cm, in the lower third on the right, the average indicator is  $44.31 \pm 2.06$  cm, while on the left -  $45.00 \pm 2.06$  cm.

Football players have a lower weight index ( $\pm 2.54$  kg), in contrast to the studied control group, taking into account the fact that the height in both groups is almost the same. It was established that the upper limbs of football players are longer on the right by  $\pm 2.22$  cm, on the left by  $\pm 2.42$  cm, than the upper limbs of representatives of the control group. The right lower limbs are longer by  $\pm 4.5$  cm, the left by  $\pm 4.35$  cm. The excursion of the chest is greater in football players, as it amounted to  $\pm 9.19$  cm, in contrast to the respondents of the control group  $\pm 7.76$  cm. The circumference of the pelvis of football players is smaller by  $\pm 2.22$  cm from the circumference of the pelvis of the subjects of the control group. The circumference of the thigh in the upper third of football players on the right prevails by  $\pm 2.22$  cm, on the left by  $\pm 5.00$  cm; the thigh circumference in the middle on the right is greater by  $\pm 4.56$  cm, on the left there is almost no difference; the thigh circumference in the lower third is greater on the right by  $\pm 1.12$  cm, on the left by 1.6 cm.

**Keywords:** anatomy, anthropometric parameters, football, students.

**Introduction.** It should be noted that individual differences of a person are manifested in various types of his activities, including in sports. Any coach wants to achieve the maximum possible result. At the same time, it should be remembered that nature has endowed us with different levels of abilities [1, 2, 3, 4].

It is important to learn to recognize them and take them into account in the practice of working with athletes, especially for a specific type of sport [5, 6, 7, 8].

A number of scientists believe that the factor that determines success in sports is the morphological features of the structure of the human body. It is known that gymnasts and acrobats are mostly short people, while basketball players, volleyball players, and high jumpers are tall. For water jumpers, you need to have a small body weight, and for sumo wrestlers, on the contrary, you need to have a significant body weight. In addition, the sports

result is largely determined by the constitution of the body [9, 10, 11, 12].

Football is a high-intensity sport that requires athletes to be active for 90 minutes, covering distances of up to 7 miles during a game on the field, according to Dr. Howard Libeskind, an orthopedist for the U.S. national soccer team. In order to stay fit enough for this challenging task, many soccer teams have specialized programs that focus on strengthening and training the muscle groups most commonly used in soccer. A recent report from the Center for Research, Education, Innovation and Intervention in Sport found that during the pre-season, youth football athletes sustain injuries at a rate of 7.2%, of which 79% involve the lower extremities, 23% are specific to the hip. A similar study of professional players by the Department of Health Sciences found that 92 percent of all muscle injuries occurred in the calf and calf muscle

groups, with 37 percent for the hamstrings, 23 percent for the adductors, 19 percent for the quads, and 13 percent calf muscles. On average, a professional soccer player runs 10 kilometers during a 90-minute match. Now it's not just about increasing lung volume—the demands of the game have grown so much that the need to be bulkier, stronger, and more explosive is more important than ever [13, 14, 15].

In our opinion, although many methods are currently available to assess the anatomical parameters of the body, there is no criterion methodology specifically defined for football players.

So, there is a need for further definition of sport-specific anthropometric parameters assessed by standardized methods to provide optimal monitoring and prediction for sport selection purposes.

**Research rationale.** Research that show the anatomical features of professional soccer players, comparing them with peers who do not play soccer and do not play sports at all, in order to establish the parameters of soccer players are relevant and require further research.

**Purpose:** the establish of anatomical parameters of the "University" team by masters of sports of Ukraine.

**Material and methods.** The research was conducted on 32 respondents aged from 16 to 18 years. The main group was made up of 16 players of the "University" football team of masters of sports of Ukraine, Chernivtsi. The control group consisted of 16 young men studying at a higher education institution in Bukovyna (Bukovyna State Medical University).

The representatives of the main group were practically healthy (no history of congenital or chronic pathology was noted), masters of sports of Ukraine, who systematically trained intensively and participated in championships of Ukraine among higher educational institutions, under the leadership of the team coach. Training took place 3-4 times a week, 1.5 hours on average. The subjects of the control group were also practically healthy young men who were loaded with hours of physical education, according to the programs of their specialty, and additionally did not play sports.

To perform this study, anthropometric measurements were carried out according to the modified method of P.P. Shaparenka [14].

Anthropometric examination included determination of total (body length and weight) parameters and partial (length of upper and lower limbs, thigh length, chest circumference during inhalation, exhalation and at rest, pelvic circumference, thigh circumference in the upper third, in the middle and lower third).

Statistical analysis of the obtained data was carried out using the licensed program RStudio. A paired t-test (t-test of paired samples) was conducted to compare the indicators of the studied main and control groups.

A vertical height gauge was used to measure height.

Body weight (weighing) was carried out on floor scales (electronic).

The length of the upper limbs was determined between two points: the upper point (shoulder) is located within the deltoid area and corresponds to the point located on the surface of the suprahumeral process of the scapula, the lower point corresponds to the finger point, which is located on the hump of the head of the terminal phalanx of the third finger. Given is a line that connects two points and passes through a pointed radial point.

The length of the lower limbs was determined between two points: the upper point is located along the crest of the wing of the iliac bone and corresponds to the iliac-crest highest point, the lower - corresponds to the lower shallow medial point, which is located at the lowest point of the medial bone.

The length of the thigh was measured with a centimeter tape between the acetabular and medial superior calcaneus points. A vertical height gauge was used to measure height.

Chest circumference was measured in three states: rest, inhalation and exhalation. When measuring, the centimeter tape passed along the lower edge near the nipple circles in front.

The circumference of the pelvis was measured with a centimeter tape in the supine position, bringing it under the sacrum, through the wings of the hip bones and the front surface of the pubic fusion (elevation).

The circumference of the thigh in the upper third was determined by applying a centimeter tape at the place of greatest fullness in the medial direction under the gluteal fold and closed on the outer surface of the thigh.

The circumference of the thigh in the middle third was determined by applying a centimeter tape in this part in the medial direction and closing it on the outer surface of the thigh.

The circumference of the thigh in the lower third was determined by applying a centimeter tape 7.0-8.0 cm above the knee joint in the medial direction and closing it on the outer surface of the thigh.

**Results.** According to the results of total and partial anthropometric parameters of football players, such as weight, height, length of upper and lower limbs, thigh, it was established that the average body weight of football players is  $74.50 \pm 3.02$  kg, height is  $181.13 \pm 3.04$  cm. Taking into account the length of the right upper limbs, the average length is  $78.50 \pm 2.02$  cm, the left -  $78.75 \pm 2.02$  cm. The length of the right lower limbs is  $92.63 \pm 2.06$  cm, the left -  $92.44 \pm 2.06$  cm. The average length of the right and left thigh is  $52.25 \pm 2.04$  cm (table 1).

Table 1

The anthropometric parameters of football players of the main group (body weight, height, length of upper limbs, lower limbs and thigh)

The anthropometric parameters							
Body weight (kg)	Height (cm)	length of upper limbs (cm)		length of lower limbs (cm)		length of thigh (cm)	
74,50±3,02	181,13±3,04	right	left	right	left	right	left
		78,50±2,02	78,75±2,02	92,63±2,06	92,44±2,06	52,25±2,04	52,25±2,04

The results of total and partial anthropometric parameters of representatives of the control group (weight, height, length of upper and lower limbs, thigh) show that the average weight is  $77.04 \pm 3.02$  kg, height is  $179.47 \pm 3.04$  cm. pay attention to the length of the right

upper limbs, the length on average is  $78.28 \pm 2.02$  cm, the left -  $76.33 \pm 2.02$  cm. The length of the right lower limbs is  $88.14 \pm 2.06$  cm, the left -  $88.09 \pm 2.06$  cm. The average length of the right thigh is  $52.90 \pm 2.04$  cm, the left thigh is  $52.94 \pm 2.04$  cm, (table 2).

**Table 2**

**Anthropometric parameters of young boys of the control group (body weight, height, length of upper limbs, lower limbs and thigh)**

The anthropometric parameters							
Body weight (kg)	Height (cm)	length of upper limbs (cm)		length of lower limbs (cm)		length of thigh (cm)	
$77,04 \pm 3,02$	$179,47 \pm 3,04$	right	left	right	left	right	left
		$76,28 \pm 2,02$	$76,33 \pm 2,02$	$88,14 \pm 2,06$	$88,09 \pm 2,06$	$52,90 \pm 2,04$	$52,94 \pm 2,04$

The results of partial anthropometric parameters of football players, such as the circumference of the chest during inhalation, exhalation and breath retention, the circumference of the pelvis, as well as the circumference of the thigh on the right and left in the upper third, in the middle and lower third, show that the average index of the circumference of the chest on inhalation is  $93.94 \pm 3.05$  cm, when exhaling -  $86.75 \pm 3.05$  cm and when holding the

breath -  $92.25 \pm 3.05$  cm. The circumference of the pelvis in football players is on average  $86.25 \pm 2.01$  cm (table 3).

The circumference of the thigh in the upper third of the right is  $55.31 \pm 2.03$  cm, on the left -  $54.18 \pm 2.03$  cm, in the middle third of the right thigh, the indicator was  $49.13 \pm 2.01$  cm, in the left -  $52.44 \pm 2.01$  cm, in the lower third on the right the indicator is on average  $44.31 \pm 2.06$  cm, while on the left -  $45.00 \pm 2.06$  cm (table 3).

**Table 3**

**Anthropometric parameters of football players (circumference of the chest, pelvis and thigh)**

The anthropometric parameters (cm)									
Circumference of the chest			Circumference of the pelvis	Circumference of the thigh					
breath	exhalation	delay		in the upper third		in the middle third		in the lower third	
$95,94 \pm 3,05$	$86,75 \pm 3,05$	$92,25 \pm 3,05$	$86,25 \pm 2,01$	right	left	right	left	right	left
				$55,31 \pm 2,03$	$54,18 \pm 2,03$	$49,13 \pm 2,01$	$52,44 \pm 2,01$	$44,31 \pm 2,06$	$45,00 \pm 2,06$

**Table 4**

**Anthropometric parameters of young boys of the control group (circumference of the chest, pelvis and thigh)**

The anthropometric parameters (cm)									
Circumference of the chest			Circumference of the pelvis	Circumference of the thigh					
breath	exhalation	delay		in the upper third		in the middle third		in the lower third	
$95,71 \pm 3,05$	$87,95 \pm 3,05$	$91,71 \pm 3,05$	$88,47 \pm 2,01$	right	left	right	left	right	left
				$53,09 \pm 2,03$	$49,19 \pm 2,03$	$44,57 \pm 2,01$	$51,80 \pm 2,01$	$43,19 \pm 2,06$	$43,42 \pm 2,06$

The results of partial anthropometric parameters (circumference of the chest during inhalation, exhalation and breath hold, pelvic circumference, thigh circumference on the right and left in the upper third, in the middle and lower third) of the studied control group show that the average index of the chest circumference on inhalation is  $95,71 \pm 3.05$  cm, when exhaling -  $87.95 \pm 3.05$  cm and when holding breath -  $91.71 \pm 3.05$  cm. The circumference of the pelvis is  $88.47 \pm 2.01$  cm on average (table 4).

The circumference of the thigh in the upper third of the right is  $53.09 \pm 2.03$  cm, on the left -  $49.19 \pm 2.03$  cm, in the middle third of the right thigh, the indicator was  $44.57 \pm 2.01$  cm, in the left -  $51.80 \pm 2.01$  cm, in the lower third on the right the indicator is on average  $43.19 \pm 2.06$  cm, while on the left -  $43.42 \pm 2.06$  cm (table 4).

**Discussion of research results.** Anthropometric is one of the main methods of examination of athletes. For coaches and athletes, anthropometric data are of great interest, because they make it possible to constantly monitor the peculiarities of physical development, individually plan the load, recommend beginner athletes to engage in one or another sport [1, 2].

Sara Jane Cullen et al., examining the anthropometric profiles of elite athletes, also concluded that quantification of body composition is central to monitoring the performance and training of athletes. The authors emphasize that there is extremely limited anthropometric data for specific sports that are assessed using a standardized method. Also, that there are differences in anthropometric profiles between different athletes and between different sports, highlighting the need to have sport-specific normative ranges available to ensure

optimal monitoring of individual athletes who differ particularly between sports, as well as age, training status and positions [9].

So, our results, which show the anatomical features of professional football players, comparing them with peers who do not play football and do not do sports at all, indicate that there is a significant difference between all the investigated values between the representatives of both groups.

Comparing total parameters such as weight and height, it becomes obvious that there is a statistical difference between the representatives of the main and control groups (football players have a lower weight index than the studied control group, taking into account that the height in both groups is almost the same ( $\pm 2.54$  kg)).

The length of the upper limbs indicates that the upper limbs of football players are longer on the right by  $\pm 2.22$  cm, on the left by  $\pm 2.42$  cm.

The length of the lower limbs also shows the difference in parameters: the right in football players is larger by  $\pm 4.5$  cm, the left by  $\pm 4.35$  cm.

The results of the length of the right and left thigh do not indicate a significant difference between the subjects of both groups.

Data on chest circumference during inhalation, exhalation and breath hold indicate that there is a difference in chest excursion, as it was  $\pm 9.19$  cm in football players, as opposed to  $\pm 7.76$  cm in the control group respondents.

There is also an obvious difference in the parameters of the circumference of the pelvis, since the pelvis in the main group of subjects is smaller by  $\pm 2.22$  cm.

The circumference of the thigh between the subjects is also different: the circumference of the thigh in the upper third of football players on the right prevails by  $\pm 2.22$  cm, on the left by  $\pm 5.00$  cm; the thigh circumference in the middle on the right is greater by  $\pm 4.56$  cm, on the left there is almost no difference; the thigh circumference in the lower third is greater on the right by  $\pm 1.12$  cm, on the left by  $1.6$  cm.

In summary, it can be concluded that our research is relevant, as it was established that professional football players, unlike students of the control group, who had a light physical load according to the program of their specialty and additionally did not play sports, have an obvious difference in almost all studied anatomical parameters, which requires further morphological research, especially establishing the parameters of the muscles of football players.

#### Conclusions:

1. Football players have a lower weight index ( $\pm 2.54$  kg), in contrast to the studied control group, taking into account the fact that the height in both groups is almost the same.

2. It was established that the upper limbs of football players are longer on the right by  $\pm 2.22$  cm, on the left by  $\pm 2.42$  cm than the upper limbs of representatives of the control group, the right lower limbs are longer by  $\pm 4.5$  cm, the left by  $\pm 4.35$  cm.

3. Excursion of the chest is greater in football players, as it amounted to  $\pm 9.19$  cm, in contrast to the respondents of the control group,  $\pm 7.76$  cm.

4. The circumference of the pelvis of football players is  $\pm 2.22$  cm smaller than the circumference of the pelvis of the control group.

5. The circumference of the thigh in the upper third of football players on the right prevails by  $\pm 2.22$  cm, on the left by  $\pm 5.00$  cm; the thigh circumference in the middle on the right is greater by  $\pm 4.56$  cm, on the left there is almost no difference; the thigh circumference in the lower third is greater on the right by  $\pm 1.12$  cm, on the left by  $1.6$  cm.

**Prospects for further research.** Further study of the anatomical parameters of football players to solve the problems of selection and sports orientation.

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**АНТРОПОМЕТРИЧНІ ДАНІ ПРОФЕСІЙНИХ  
ФУТБОЛІСТІВ БУКОВИНИ**

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**Резюме.** З метою встановлення анатомічних параметрів у команди майстрів спорту України з футболу «Університет» проведено дослідження на 32-х респондентах, віком від 16 до 18 років. Основну групу склали 16 гравців команди майстрів спорту України з футболу, контрольну групу склали 16 юнаків, які навчаються у закладі вищої освіти Буковини.

Антропометричне обстеження містило: вагу, зріст, довжину верхніх та нижніх кінцівок, довжину стегна, окружність грудної клітки при вдиху, видиху та в стані спокою, окружність тазу, окружність стегна у верхній третині, у середині та нижній третині. За результатами довжина правих верхніх кінцівок в середньому становить  $78,50 \pm 2,02$  см, лівих –  $78,75 \pm 2,02$  см. Довжина правих нижніх кінцівок складає  $92,63 \pm 2,06$  см, лівих –  $92,44 \pm 2,06$  см. Середня довжина правого та лівого стегна становить  $52,25 \pm 2,04$  см. Окружність стегна у верхній третині справа становить  $55,31 \pm 2,03$  см, зліва –  $54,18 \pm 2,03$  см, у середній третині правого стегна показник склав  $49,13 \pm 2,01$  см, лівого –  $52,44 \pm 2,01$  см, у нижній третині справа показник в середньому становить  $44,31 \pm 2,06$  см, у той час зліва –  $45,00 \pm 2,06$  см.

Верхні кінцівки футболістів довші справа на  $\pm 2,22$  см, зліва на  $\pm 2,42$  см від верхніх кінцівок представників контрольної групи. Праві нижні кінцівки довші на  $\pm 4,5$  см, ліві на  $\pm 4,35$  см. Експерсія грудної клітки більша у футболістів, оскільки вона склала  $\pm 9,19$  см, на відміну від контрольної групи  $\pm 7,76$  см. Окружність тазу футболістів менша на  $\pm 2,22$  см від окружності тазу контрольної групи. Окружність стегна у верхній третині справа у футболістів переважає на  $\pm 2,22$  см, зліва на  $\pm 5,00$  см; окружність стегна в середині справа більша на  $\pm 4,56$  см, зліва різниці майже немає; окружність стегна в нижній третині справа більша на  $\pm 1,12$  см, зліва на  $1,6$  см.

**Ключові слова:** анатомія, антропометричні параметри, футбол, студенти.

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