The determination of distal hip circumference in universities students depending on the sport type

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Abstract

Purpose: to find out the features of hip girth (distal) of both limbs of young boys and young girls of Bukovynian higher educational institutions, depending on the sport type.

Materials and methods: 115 students of Bukovynian higher education institutions aged from 16 to 21 years old participated in the study, 78 (67.82%) of them were young boys and 37 (32.18%) were young girls. The main group was 75 (65.22 %) students of the I-II courses of the Faculty of Physical Culture and Human Health (the Yuriy Fedkovich Chernivtsi National University), the control group - 40 (34.78%) college students and students of the Stomatological Faculty of the Bukovynian State Medical University, who underwent an anthropometric study, according to the method of V.V. Bunaka in the modification of P.P. Shaparenko (determination of body weight and hip girth distally).

Results: a comparison of the length of the distal right and left hip girth of young boys and young girls of both groups shows that the length of the right hip girth of young boys and young girls is bigger than the left: the main group (right in young boys - 48.50±2.0 cm, left - 42.25 ±2.0 cm; right in young girls – 48.59±2.0 cm; left – 41.74±2.0 cm), control group (right in young boys - 49.19±2.0 cm, left – 44 ,42±2.0 cm; young girls’ right - 46.57±2.0 cm; left - 41.52±2.0 cm). The conducted regression analysis shows that gender and weight are significant factors for hip girth distally on the right and left.

Conclusions: the model for predicting the circumference of the distal right thigh has the equation: \( y = \beta_1 + \beta_2 +0.318\times x \), where \( y \) is the distal right thigh circumference, \( x \) is weight. Coefficient \( \beta_1 = 29.848 \) for young girls and \( \beta_2 = 25.95 \) for young boys. The coefficient of determination is 0.994. On the left, it has the equation: \( y = \beta_1 + \beta_2 +0.292\times x \), where \( y \) is the hip girth on the distal left, \( x \) is weight. Coefficient \( \beta_1 = 29.848 \) for women and \( \beta_2 = 21.901 \) for men. The coefficient of determination is 0.991.

Key words: young boys and young girls, anthropometric studies, distal hip girth
Анотація

Світлана Каратєєва, Олександр Слободян, Тарас Лукашів, Галина Гончар, Володимир Комар, Світлана Козловська. Визначення обхвату стегна дистально у студентів університетів залежно від виду спорту.

Мета: з'ясувати особливості обхвату стегна (дистально) обох кінцівок юнаків та дівчат закладів вищої освіти Буковини залежно від виду спорту.

Матеріали та методи: в дослідженні брали участь 115 студентів закладів вищого освіти Буковини віком від 16 до 21 року, з них 78 (67,82 %) становлять юнаки та 37 (32,18%) дівчата, основна група – 75 (65,22 %) студентів I-II курсів факультету фізичної культури та здоров'я людини Чернівецького національного університету імені Юрія Федьковича, контрольна група – 40 (34,78 %) студентів коледжу та студенти стоматологічного факультету Буковинського державного медичного університету, яким проведено антропометричне дослідження, за методикою В.В. Бунака у модифікації П.П. Шапаренка (визначення маси тіла та обхват стегна дистально).

Результати: порівняння довжини обхвату дистально правого і лівого стегна юнаків і дівчат обох груп показує, що довжина обхвату правого стегна юнаків і дівчат більша ніж лівого: основна група (справа у юнаків – 48,50±2,0 см, зрівняло – 42,25±2,0 см; справа у дівчат – 48,59±2,0 см; зрівняло – 41,74±2,0 см), контрольна група (справа у юнаків – 49,19±2,0 см, зрівняло – 44,42±2,0 см; справа у дівчат – 46,57±2,0 см; зрівняло – 41,52±2,0 см). Проведений регресионний аналіз показує, що значущими факторами для обхвату стегна дистально справа та зрівняло є стаття, вага.

Висновки: модель для прогнозування кола обхвату бедра дистально має вигляд у = β1+β2+0,318*х, де у - обхват стегна дистально справа, х - вага. Коэфіцієнт β1=29,848 для жінок і β2=25,95 для чоловіків. Коефіцієнт детермінації становить 0,994. За стаття, вага. Висновки: модель для прогнозування кола обхвату бедра дистально має вигляд у = β1+β2+0,318*х, де у - обхват стегна дистально справа, х - вага. Коэфіцієнт β1=29,848 для жінок і β2=25,95 для чоловіків. Коефіцієнт детермінації становить 0,994. За стаття, вага. Висновки: модель для прогнозування кола обхвату бедра дистально має вигляд у = β1+β2+0,318*х, де у - обхват стегна дистально справа, х - вага. Коэфіцієнт β1=29,848 для жінок і β2=25,95 для чоловіків. Коефіцієнт детермінації становить 0,994. Зліва має вигляд y = β1+β2+0,292*х, де у - обхват стегна дистально зліва, х - вага. Коэфіціент β1 = 29,848 для жінок і β2 = 21,901 для чоловіків. Коефіцієнт детермінації становить 0,991.

Ключові слова: юнаки та дівчата, антропометричні дослідження, обхват стегна дистально

Аннотация

Светлана Каратеева, Александр Слободян, Тарас Лукашев, Галина Гончар, Владимир Комар, Светлана Козловская. Определение обхвата бедра дистально у студентов университетов в зависимости от вида спорта.

Цель: выяснить особенности охвата бедра (дистально) обеих конечностей юношей и девушек заведений высшего образования Буковины в зависимости от вида спорта.

Материалы и методы: в исследовании принимали участие 115 студентов высших учебных заведений Буковины в возрасте от 16 до 21 года, из них 78 (67,82 %) составляют юноши и 37 (32,18%) девушки, основную группу – 75 (65,22) %) студентов I-II курсов факультета физической культуры и здоровья человека Черновицкого национального университета имени Юрия Федьковича, контрольную группу – 40 (34,78 %) студентов колледжа и студенты стоматологического факультета Буковинского государственного медицинского университета, которым проведено антропометрическое исследование, по методике В.В. Бунака у модификации П.П. Шапаренка (определение массы тела и обхват бедра дистально).

Результаты: сравнение длины охвата бедра дистально правого и левого бедра юношей и девушек обоих групп показывает, что длина охвата правого бедра юношей и девочек больше левого: основная группа (справа у юношей – 48,50±2,0 см, слева – 42,25 ±2,0 см, справа у девочек – 48,59±2,0 см; слева – 41,74±2,0 см), контрольная группа (справа у юношей – 49,19±2,0 см, слева – 44,42±2,0 см; справа у девочек – 46,57±2,0 см; слева – 41,52±2,0 см). Проведенный регрессионный анализ показывает, что значимыми факторами для охвата бедра дистально справа та слева являются пол, вес.

Заключение: модель для прогнозирования окружности охвата бедра дистально справа имеет вид у = β1+β2+0,318*x, где у – обхват бедра дистально справа, х – вес. Коэффициент β1=29,848 для женщин и β2=25,95 для мужчин. Коэффициент детерминации составляет 0,994. Слева имеет вид у = β1+β2+0,292*x, где у – обхват бедра дистально слева, х – вес. Коэффициент β1 = 29,848 для женщин и β2 = 21,901 для мужчин. Коэффициент детерминации составляет 0,991.

Ключевые слова: юноши и девушки, антропометрические исследования, обхват бедра дистально
Introduction

The level of results in modern sports is so high that athletes need to have the appropriate morphological and functional data for their achievement, as well as excellent physical and mental abilities. Therefore, the main problem in athletes training is an adequate selection and sports orientation [1-3]. Solving selection problems involves the creation of a model of an athlete of the appropriate sport, i.e. a certain set of characteristics that determine sports performance [4-6]. The set of signs and the order of their enumeration differs for different sports [7-9].

However, until now, the prognostic value and predominance of indicators of total and partial body dimensions, morphometric and somatotypological characteristics in predicting prospects for achieving high results in sports have not been established [10-12].

More recently, data have emerged on the anthropometric profiles of open water swimmers [13], elite youth runners [14], Olympic bikers [15], and professional basketball players [16].

Some authors, examining the anthropometric profiles of elite athletes, have concluded that the quantification of body composition is central for monitoring the performance and training of athletes, but there is extremely limited anthropometric data for specific sports that are assessed using a standardized method. There are variations also in anthropometric profiles among different athletes and among different sports, highlighting the need to have sport-specific normative ranges available to ensure optimal monitoring of individual athlete that differ particularly between sports, as well as age, training status and positions [17, 18].

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

In our opinion, taking into account the data of the literature, it is the further establishment of anthropometric parameters of individual sports, with the subsequent construction of a model for solving the problems of selection and sports orientation, that is relevant and necessary in modern sports.

Creating the model based on anthropometric parameters will allow us to conduct sports selection among future athletes in order to achieve excellent results in professional sports.

Purpose: to find out the peculiarities of hip girth (distal) of both limbs of young boys and young girls of higher education institutions of Bukovyna, depending on the type of sport.

Materials and methods

Participants

The determination of anthropometric parameters was carried out on 115 students of Bukovynian higher educational institutions aged from 16 to 21 years, where 78 (67.82%) are young boys and 37 (32.18%) - young girls. The main group of 75 (65.22%) students were represented by the first and the second year students of the Faculty of Physical Culture and Human Health of the Yuriy Fedkovich Chernivtsi National University, and control group consisted of 40 (34.78%) college students and students of the Stomatological Faculty of Bukovynian State Medical University.

Among these students of the main group 57 (76.0%) were young boys and 18 (24.0%) - young girls who, in addition to their physical activity obliging in the program of specialty, additionally have engaged next sports: (1) football players - 40 (53.34%), where 36 (48.0%) – in young boys, and 4 (5.34%) - in young girls; (2) volleyball players – 18 (24.0%), where 9 (12.0%) - in young boys, and 9 (12.0%) - in young girls; (3) tennis players – 10 (13.34%), where 8 (10.67%) - in young boys, and 2 (2.67%) - in young girls; (4) basketball players – 7 (9.32%), where – 4 (5.32 %) - in young boys, and 3 (4.0%) - in young girls. The control group consisted of 21 (52.5%) young boys and 19 (47.5%) – of young girls who had obligatory, in accordance to the curriculum of their specialty hours of physical training as educational purpose, and had no any sport trainings at all.

The mean value of students body weight in the main group was: 69.70 ± 3.02 kg in young boys and - 56.62 ± 3.02 kg – in young girl. (1) volleyball players had the highest mean value body weight - (67.88 ± 3.02 kg), where young boys weigh was 70.65±3.02 kg and young girls - 64.50±3.02 kg; (2) football players mean value was (67.58±3.02 kg), where young boys weigh was 69.20±3.02 kg and 63.56±3.02 kg – in young girls; (3) basketball players mean value was - (67.57 ± 3.02 kg), where young boys weigh was 69.00 ± 3.02 kg and 63.10 ± 3.02 kg –in young girls; (4) tennis players have slightly less weight - (61.50 ± 3.02 kg), where young boys weigh was 64.04±3.02 kg and 58.51±3.02 kg - in young girls. The mean value weight in the control group of students was: young boys - 77.04 ±3.02 kg, young girls - 56.10 ±3.02 kg.

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The mean circumference of the distal right thigh in the main group of students was: (1) volleyball players - (50.50±2.0 cm), where young boys had 49.90±2.0 cm and young girls - 49.60±2.0 cm; (2) basketball players - (50.00±2.0 cm), where young boys had 49.80±2.0 cm and 49.20±2.0 cm - in young girls; (3) football players - (48.62±2.0 cm), where young boys had 48.60±2.0 cm and 48.02±2.0 cm - for young girls; (4) tennis players - (46.10±2.0 cm), where young boys had 45.95±2.0 cm and 45.15±2.0 cm - for young girls. Among students of the control group, the average girth length in the middle third of the right thigh was (47.95±2.0 cm), where young boys had 49.19±2.0 cm and 46.57±2.0 cm - in young girls.

Distally examined circumference of the left thigh of the main group of students was: (1) volleyball players - (44.16±2.0 cm), where young boys had 44.10±2.0 cm and 44.06±2.0 cm - in young girls; (2) basketball players - (43.00±2.0 cm), where young boys had 42.96±2.0 cm and 42.04±2.0 cm - for young girls; (3) football players – (41.90±2.0 cm), where young boys had 41.55±2.0 cm and 41.35±2.0 cm - for young girls; (4) tennis players - (40.40±2.0 cm), where young boys had 40.42±2.0 cm and 40.15±2.0 cm - for young girls. Among the students of the control group, the average girth length in the middle third of the left thigh was (43.05±2.0 cm), where young boys had 44.42±2.0 cm and 41.52±2.0 cm - in young girls.

Procedure

Young boys and young girls were subjected to an anthropometric study, according to the method of V.V. Bunaka in the modification of P.P. Shaparenka [19], which contained the determination of total (body weight) parameters and partial (distal thigh girth).

Determination of body weight was carried out on floor scales (mechanical). The thigh girth was determined distally 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 (according to the method of V.V. Bunak, modified by P.P. Shaparenko).

The Shapiro-Wilk test showed that the data in the "football players" group are not normally distributed (W=0.901, p=0.002). Up for the other groups, there is insufficient evidence to reject the null hypothesis of a normal sampling distribution (all p>0.05). Since the assumption of normality of samples in each group by sport is violated, so that the ANOVA test cannot be used to test the hypothesis of equality of mean values of hip circumference in the main group by sport.

To compare the length of the hip girth in the main group depending on sport, the Kruskel-Wallis test (non-parametric ANOVA) was used to identify a significant difference in the average indicators of the respondents depending on the sport (the median of the distribution is considered as a measure of central tendency), since averages (as a measure of central tendency) are compared in more than 2 groups, to test the hypothesis of a statistically significant difference in averages, analysis of variance (ANOVA) should be used, however, ANOVA-test is based on the assumption of a normal distribution of the sample in each group. In our case, this assumption is violated, so we use the non-parametric Kruskal-Wallis test, which tests the hypothesis of equality of medians in each group. Here, the median is used as a measure of central tendency because it is more robust to random outliers than the mean. [20]. To establish for which pairs of age groups there is a statistical difference in the medians, the Conover-Iman test was used [21]. Statistical analysis of the obtained data was performed using the licensed RStudio program.

Results

The distribution of the length of the hip girth on the right of the main group of subjects shows that there is no significant average difference in the length of the hip girth (distal) on the right among young boys and young girls (Fig. 1). This is also evidenced by Welch’s t-test: t (34,579) = 0.073, p = 0.942.

The distribution of the length of the thigh girth on the right of the control group subjects also shows that there is no significant average difference in the length of the thigh girth (distal) on the right of young boys and young girls (Fig. 2). This is also evidenced by Welch’s t-test: t (34,865) = - 1.439, p = 0.159.
The distribution of the length of the thigh girth distal on the right of the subjects of the main group depending on the sport looks like there is a significant difference in the average value of the length of the thigh girth (distal) right depending on the type of sport, taking into account the control group (Fig. 3).

The results of the Kruskel-Wallis test \( (x^2 (6) = 14.045, p = 0.029) \). Since \( p = 0.029 \leq 0.05 \), the difference between the medians of the groups is statistically significant.

To establish for which pairs of age groups there is a statistical difference in the medians, we will conduct the Conover-Iman test. The results are as follows: there is a significant difference for the pairs "volleyball"-"control", "volleyball"-"football", "volleyball"-"tennis". No significant differences were found for other groups.

Fig. 1. Distribution of the length of the hip girth (distal) on the right of respondents of the main group by gender

Fig. 2. Distribution of hip girth length (distal) on the right of respondents in the control group by gender

Fig. 3. Distribution of the length of the hip girth (distal) on the right of the respondents by the type of sport
The distribution of the length of the hip girth on the distal left of the main group of subjects shows that there is no significant average difference in the length of the hip girth (distal) on the left of young boys and young girls (Fig. 4). This is also evidenced by Welch's t-test: $t(45.043) = -0.511$, $p = 0.612$.

The distribution of the length of the hip girth on the distal left of the control group also shows that there is no significant average difference in the length of the hip girth (distal) on the left of young boys and young girls (Fig. 5). This is also evidenced by Welch's t-test: $t(37.74) = -1.490$, $p = 0.145$.

The distribution of the length of the hip girth on the distal left of respondents depending on sport looks like there is a significant difference in the average value of the length of the hip girth (distal) on the left depending on the type of sport, including the control group (Fig. 6). The results of the Kruskal-Wallis test ($\chi^2(6) = 7.591$, $p = 0.270$. Since $p = 0.269$
The length of the hip girth (distal) on the right.

The coefficient of determination is 0.994.

It was also established that there is a significant difference in the average value of the length of the hip girth (distal) on the left depending on the type of sport, taking into account the control group (Fig. 6). The conducted regression analysis shows that gender and weight are significant factors for hip girth distal on the left.

The model for predicting the circumference of the thigh on the distal left has the form: $y = \beta_1 + \beta_2 + 0.292 \times x$, where “$y$” is the circumference of the thigh on the distal left, “$x$” is weight. Coefficient $\beta_1 = 29.848$ for young girls and $\beta_2 = 21.901$ for young boys. The coefficient of determination is 0.991.

When comparing the right and left thigh distally, there is a significant difference in the average value of the length of the thigh girth distally on the left and right ($t(256) = 9.713, p = \leq 0.05$).

Conclusions

1. A comparison of the length of the distal right and left hip circumference of young boys and young girls of both groups shows that the length of the right hip circumference of young boys and young girls is bigger than the left: the main group (right in young boys - 48.50±2.0 cm, left - 42.25±2.0 cm; right in young girls - 48.59±2.0 cm; left - 41.74±2.0 cm), control group (right in young boys - 49.19±2.0 cm, left - 44.42±2.0 cm; young girls' right - 46.57±2.0 cm; left - 41.52±2.0 cm).

2. Comparison analysis revealed that the largest length of the girth of the right distal hip have: (1) volleyball players - (50.50±2.0 cm), where young boys have 49.90±2.0 cm and 49.60±2.0 cm - in young girls and (2) basketball players - (50.00±2.0 cm), where young boys have 49.80±2.0 cm and 49.20±2.0 cm - in young girls; (3) football players are somewhat smaller - (48.62±2.0 cm), where young boys have 48.60±2.0 cm and 48.02±2.0 cm - in young girls and the smallest mean have (4) tennis players - (46.10±2.0 cm) where young boys have 45.95±2.0 cm and 45.15±2.0 cm - in young girls.

3. Comparison analysis revealed that the largest length of the left hip girth distally have: (1) volleyball players - average mean value (44.16±2.0 cm), where young boys have 44.10±2.0 cm and 44.06±2.0 cm - in young girls and (2) basketball players - (43.00±2.0 cm), where young boys have 42.96±2.0 cm and 42.04±2.0 cm - in young girls. Next were (3) football players with average mean value (41.90±2.0 cm), where young boys have 41.55±2.0 cm and 41.35±2.0 cm - in young girls, and (4) tennis players have the smallest average mean value (40.40±2.0 cm), where young boys have 40.25±2.0 cm and 40.15±2.0 cm - in young girls.
The conducted regression analysis shows that gender and weight are significant factors for hip girth on the distal right and left.

5. The model for predicting the circumference of the distal right thigh has the equation $y = \beta_1 + \beta_2 + 0.318 \times x$, where “$y$” - is the distal right thigh circumference, “$x$” - is weight. Coefficient $\beta_1 = 29.848$ for young girls and $\beta_2 = 25.95$ for young boys. The coefficient of determination is 0.994. On the left, it has the equation $y = \beta_1 + \beta_2 + 0.292 \times x$, where “$y$” - is the hip girth on the distal left, “$x$” - is weight. Coefficient $\beta_1 = 29.848$ for young girls and $\beta_2 = 21.901$ for young boys. The coefficient of determination is 0.991.

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Conflict of interest

The authors declare that there is no conflict of interest.

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