10. Greydanus DJ, Hassmann LL, Butler FK Jr. Quality Assurance in Tactical Combat Casualty Care for Medical Personnel Training 16 April 2020. J Spec Oper Med. 2020 Summer;20(2):95–103. doi: 10.55460/T63H-3OXX.

11. Gurney JM, Stern CA, Kotwal RS, Cunningham CW, Burelison DR, Gross KR, et al. Tactical Combat Casualty Care Training, Knowledge, and Utilization in the US Army. 2020; 185(1) :500–507. doi: 10.1093/milmed/usz303.

12. Ministry of Defense. Allied Joint Doctrine for Medical Support. NATO Standard AJP-4.10 [Internet]. NATO: NATO Standardization office; 2019 [cited 2022 Nov 7]. 192 p. Available from: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/922182/doctrine_nato_med_spt_ajp_4_10.pdf.

13. Nichols R, Noury L. Assessing Baseline Proficiency of National Guard Combat Medics Due for Recertification: A Pilot Study. Mil Med. 2021 Dec 22: usab 525. doi: 10.1093/milmed/usab525.

14. Scott SM, Carman MJ, Zychowicz ME, Shapiro ML, True NA. Implementation and Evaluation of Tactical Combat Casualty Care for Army Aviators. Mil Med. 2020 Aug 14;185(7–8):e1271–e1276. doi: 10.1093/milmed/usz491.

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DETERMINATION OF PROXIMAL THIGH CIRCUMFERENCE IN STUDENTS OF BUKOVINIAN HIGHER EDUCATION INSTITUTIONS DEPENDING ON THE TYPE OF SPORT

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As a result of the anthropometric study of 115 students in the first and second years of higher education institutions in Chernivtsi, aged from 16 to 18 years, it was established that basketball players have the greatest length of the proximal circumference of the right thigh – 54.14±2.0 cm, of which 54.06±2.0 cm for boys and 54.08±2.0 cm for girls and volleyball players – 54.00±2.0 cm, of which 53.10±2.0 cm for boys and 53.90±2.0 cm for girls, slightly smaller in football players – 52.27±2.0 cm, of which 51.80±2.0 cm for boys and 52.47±2.0 cm for girls and the smallest tennis player – 48.80±2.0 cm, of which 48.10±2.0 cm for boys and 48.70±2.0 cm for girls. By comparison, volleyball players have the greatest proximal length of the left thigh circumference – 51.77±2.0 cm, of which 51.57±2.0 cm for boys and 51.20±2.0 cm for girls and basketball players – 50.00±2.0 cm, of which 50.20±2.0 cm for boys and 49.80±2.0 cm for girls, slightly smaller in football players – 48.07±2.0 cm, of which 48.05±2.0 cm for boys and 48.02±2.0 cm for girls and the smallest in tennis players – 45.70±2.0 cm, of which 45.45±2.0 cm for boys and 45.30±2.0 cm for girls.

Key words: students, antoropometric parameters, proximal thigh circumference.

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ВИЗНАЧЕННЯ ПРОКСИМАЛЬНОГО ОБХВАТУ СТЕГНА У СТУДЕНТІВ ЗАКЛАДІВ ВИЩОЇ ОСВІТИ БУКОВИНИ ЗАЛЕЖНО ВІД ВИДУ СПОРТУ

В результаті проведеного антропометричного дослідження 115 студентів першого та другого курсів закладів вищої освіти м. Чернівці, віком від 16 до 18 років встановлено, що найбільшу довжину проксимального обхвату стегна справа мають баскетболісти – 54,14±2,0 см, з них 54,06±2,0 см у юнаків та 54,08±2,0 см у дівчат та волейболісти – 54,00±2,0 см, з них 53,10±2,0 см у юнаків та 53,90±2,0 см у дівчат; дещо меншу футболісти – 52,27±2,0 см, з них 51,80±2,0 см у юнаків та 52,47±2,0 см у дівчат та найменшу тенісисти – 48,80±2,0 см, з них 48,10±2,0 см у юнаків та 48,70±2,0 см у дівчат. За порівнянням найбільшу довжину проксимального обхвату стегна зліва мають волейболісти – 51,77±2,0 см, з них 51,57±2,0 см у юнаків та 51,20±2,0 см у дівчат та баскетболісти – 50,00±2,0 см, з них 50,20±2,0 см у юнаків та 49,80±2,0 см у дівчат, дещо меншу футболісти – 48,07±2,0 см, з них 48,05±2,0 см у юнаків та 48,02±2,0 см у дівчат та найменшу тенісисти – 45,70±2,0 см, з них 45,45±2,0 см у юнаків та 45,30±2,0 см у дівчат.

Ключові слова: студенти, анторопометричні параметри, проксимальний обхват стегна.

One of the means of studying the state of human health is the anthropometric assessment of its physical development with the determination of overall and component indicators. The study of age norms and variations of somatic signs should be combined with establishing relative proportional indicators of body parts and somatypological features of their structure [1, 2]. These studies allow us to determine the standards of physical development, considering the periods of puberty and aging processes. In addition, these standards require periodic renewal in connection with the acceleration processes occurring in society [4].

Two main areas of human research differ both in their approach to the problem of determining the norm and the methods that are used in this case – it is a generalizing direction that reveals the general,

unified, typical properties of a person and an individualizing direction that postulates a certain variability, dissimilarity of human characteristics [5–7]. The relationship between these two directions remains the subject of discussion and various points of view. However, the research of most authors indicates the need to understand the concept of "norm" as a dialectical unity of the general and individual, personal in the dynamics of human development [8, 10].

One of the most critical problems of modern morphology is the study of changes that occur in the body under the influence of various factors. This problem becomes especially important in connection with the development of sports [9]. High athletic performance associated with significant loads on the athlete's body encourages scientists, doctors, and coaches to search for the body's physiological reserves and optimal training regimens. From this point of view, studying changes that occur in individual organs, systems and the body as a whole under the influence of physical loads of varying intensity and nature is relevant and has important practical significance [11, 13].

The level of results in modern sports is so great that athletes need to have the appropriate morphological and functional data and excellent physical and mental abilities for their achievements. Therefore, the main problem in training athletes is the adequate selection and sports orientation. Solving selection problems involves creating a model of an athlete of a given specialization, i.e., a particular set of characteristics that determine sports performance. The set of signs and the order of their enumeration differs for different sports. During sports selection, such morphological features as total and partial body sizes, body proportions, and body weight composition are considered [12].

However, the predictive value and dominance of total and partial body size indicators and morphometric and somatotypological characteristics in predicting prospects for achieving high results in sports have yet to be established [14, 15].

The purpose of the study was to determine the features of the proximal thigh circumference of both limbs of students of Bukovinian higher education institutions, depending on the type of sport.

Materials and methods. We studied anthropometric parameters on 115 first- and second-year students of higher education institutions in Chernivtsi, aged 16 to 18, of whom 78 (67.82 %) were boys and 37 (32.18 %) were girls.

The main group was 75 (65.22 %) students of the Faculty of Physical Culture and Human Health of the Yuriy Fedkovych Chernivtsi National University. The control group comprised 40 (34.78 %) college students and students of the Dental Faculty of Bukovinian State Medical University.

The main group comprised 57 (76.0 %) boys and 18 (24.0 %) girls. The control group consisted of 21 (52.5 %) boys and 19 (47.5 %) girls.

The weight of the studied patients of the main group was: girls – 56.62±3.02 kg, boys – 69.70±3.02 kg. The weight of students in the control group was: male – 77.04 ±3.02 kg, female – 56.10±3.02 kg.

The height of the studied students of the main group was: girls – 169.92±2.03 cm, boys – 178.98±2.03 cm. The average height of students in the control group was 172.25 ± 2.03 cm (boys – 179.47±2.03 cm, girls – 164.26±2.03 cm).

The proximal circumference of the right thigh of the studied students of the main group was: basketball – 54.14±2.0 cm, of which 54.06±2.0 cm for boys and 54.08±2.0 cm for girls; volleyball – 54.00±2.0 cm, of which 53.10±2.0 cm for boys and 53.90±2.0 cm for girls; football – 52.27±2.0 cm, of which 51.80±2.0 52.47±2.0 cm for girls; tennis – 48.80±2.0 cm, of which 48.10±2.0 cm for boys and 48.70±2.0 cm for girls. The average length of the proximal circumference of the right thigh of students in the control group was 51.65±2.0 cm, 53.09±2.0 cm in boys and 50.05±2.0 cm in girls.

The proximal circumference of the left thigh of the studied objects of the main group was: basketball – 50.00±2.0 cm, of which 50.20±2.0 cm for boys and 49.80±2.0 cm for girls; volleyball – 51.77±2.0 cm, of which 51.57±2.0 cm for boys and 51.20±2.0 cm for girls; football – 48.07±2.0 cm, of which 48.05±2.0 48.02±2.0 cm for girls; tennis – 45.70±2.0 cm, of which 45.45±2.0 cm for boys and 45.30±2.0 cm for girls. The average length of the proximal circumference of the left thigh of students in the control group was 48.02±2.0 cm, including 49.19±2.0 cm in boys and 46.73±2.0 cm in girls.

All students underwent an anthropometric study (body length and weight, proximal thigh circumference) according to the method of V.V. Bunak in the modification of P.P. Shaparenko [3].

Body weight was determined on floor scales, and a vertical height gauge was used to measure height. The proximal thigh circumference was determined by applying a centimetre tape at the site of greatest fullness in the medial direction under the gluteal fold and closing on the outer surface of the thigh.

When studying the distribution of thigh circumference in the main group, the Kruskal–Wallis H 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). The Conover-Iman post-hoc test (1979) was used to determine which pairs of age groups have a statistical difference in the medians. Statistical analysis of the obtained data was carried out using the licensed program RStudio.

Results of the study and their discussion. The competitive result of the athletes depends most on the physical development and anthropometric data of the athletes. However, until now, the predictive value and dominance of total and partial body size indicators and morphometric and somatotypological characteristics in predicting prospects for achieving high results in sports have yet to be established. Because the level of developments in modern sports is so great that athletes need to have the appropriate morphological and functional data and excellent physical and mental abilities for their achievements.

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.

Our studies of the distribution of the length of the proximal thigh circumference on the right show that there is no significant difference in the length of boys and girls on average in both groups. The Welch t-test of the main group: $t(44.931)=0.275$, $p=0.784$, and Welch's t-test of the control group: $t(37.989)=1.465$, $p=0.151$ also evidenced that (Fig.1).
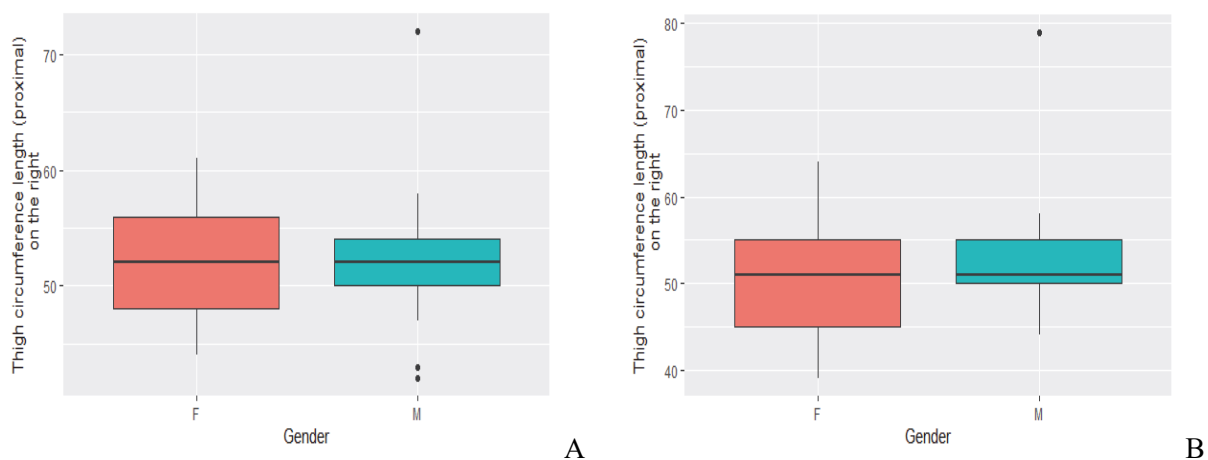

Fig. 1. Distribution of the length of the right proximal thigh circumference of the respondents of the main and control groups by gender.

Studies of the distribution of the length of the proximal thigh circumference on the right of respondents by a sport show that there is a significant difference in the average value of the length of the right proximal thigh circumference depending on the type of sport, taking into account the control group (fig. 2). Also, the results of the Kruskal–Wallis test ($x^2(6)=16.369$, $p=0.012$). Since $p=0.012$, ≤ 0.05, the difference between the medians of the groups is statistically significant.
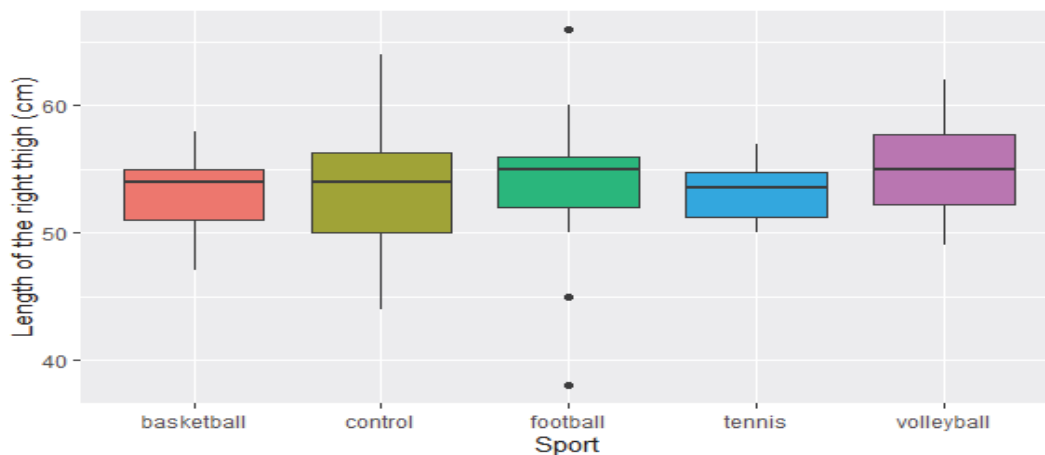

Fig. 2. Distribution of the length of the right proximal thigh circumference of the respondents by type of sport.

The distribution of the proximal thigh circumference length on the left side looks like there is no significant difference on the left side of boys and girls on average in both studied groups. This is also evidenced by the Welch t-test in the main group: $t(46.621)=0.475$, $p=0.637$ and the Welch t-test performed in the control group: $t(35.707)=1.415$, $p=0.166$.
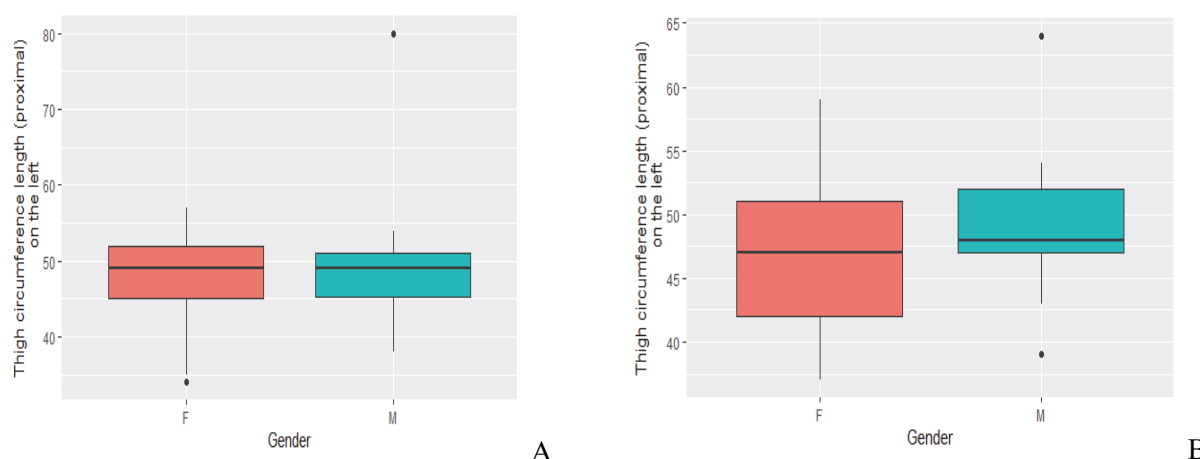
Fig. 3. Distribution of the length of the left proximal thigh circumference of the respondents of the main and control groups by gender

Studies show that in the distribution of the length of the proximal thigh circumference on the left, depending on the type of sport, there is a significant difference in the average value, taking into account the control group as well (fig. 4). Kruskal–Wallis test results ($x2$ (6=14.405, p=0.025). Since p=0.025, ≤0.05, the difference between the medians of the groups is statistically significant.
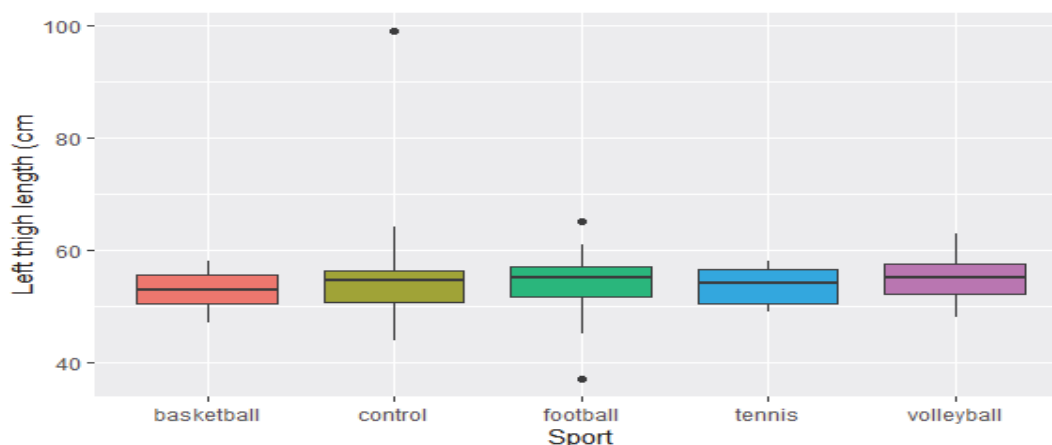

Fig. 4. Distribution of the length of the left proximal thigh circumference of the respondents by type of sport.

Comparison of the length of the proximal circumference of the right and left thighs of students of the main group shows that the length of the proximal circumference of the right thigh of boys and girls is greater than that of the left (thigh circumference on the right in boys – 52.00±2.0 cm, on the left – 48.64±2.0 cm; in girls on the right – 52.29±2.0 cm; on the left – 48.00±2.0 cm).

Comparison of the length of the proximal circumference of the right and left thighs of boys and girls of the control group shows that the length of the proximal circumference of the right thigh of boys and girls is greater than the left (thigh circumference on the right in boys – 53.09±2.0 cm, on the left – 49.19±2.0 cm; in girls on the right – 50.05±2.0 cm; on the left – 46.73±2.0 cm).

Therefore, there is no doubt that anthropometric parameters are essential for achieving high results in sports. We considered the results of a scientific study by Ratko Pavlovich, Ilon Mikhailovich and others, who analyzed the best results of male sprinters and concluded that height and body weight did not have a statistically significant effect on the results of the 60 m sprint. In contrast, their influence is evident at 100 m, especially at 200 m. According to them, such influence on the result of running 100 and 200 m is a consequence of the exceptional motor-functional capabilities of the sprinter to show greater strength in the last phase of the rebound. Otherwise, in a sprint, the rear bounce phase is much more important than the front bounce phase. A long step with the sprinter's body weight (muscles) creates a greater rebound force, guaranteeing a good result with a high frequency of actions and good technique [12].

Our research is relevant, as it has been established for which pairs of age groups there is a statistical difference in the medians for the distribution of the length of the right thigh circumference (proximal) by sport. Based on the Conover-Iman test, it was found that there is a significant difference for the pairs "basketball" – "tennis", "football" – "tennis", "volleyball" – "control", "volleyball" – "football", "volleyball" – "tennis". No significant differences were found for other groups.

Regression analysis showed that gender, sport, weight, and height are significant factors for the proximal thigh circumference on the right.

By comparison, basketball players have the greatest length of the proximal circumference of the right thigh – 54.14±2.0 cm, of which 54.06±2.0 cm for boys and 54.08±2.0 cm for girls and volleyball players – 54.00±2.0 cm, of which 53.10±2.0 cm for boys and 53.90±2.0 cm for girls, slightly smaller in football players – 52.27±2.0 cm, of which 51.80±2.0 cm for boys and 52.47±2.0 cm for girls and the smallest tennis player – 48.80±2.0 cm, of which 48.10±2.0 cm for boys and 48.70±2.0 cm for girls.

It was also established for which pairs of age groups there is a statistical difference in the median distribution of the length of the thigh circumference (proximal) on the left by sport using the Conover-Iman test. The results are as follows: there is a significant difference for the pairs "basketball" – "tennis", "football" – "tennis", "volleyball" – "control", "volleyball" – "football", "volleyball" – "tennis". No significant differences were found for other groups.

Regression analysis showed that weight and height are significant factors for the proximal thigh circumference on the left.

By comparison, volleyball players have the greatest length of the left thigh circumference – 51.77±2.0 cm, of which 51.57±2.0 cm for boys and 51.20±2.0 cm for girls and basketball players – 50.00±2.0 cm, of which 50.20±2.0 cm for boys and 49.80±2.0 cm for girls, slightly smaller in football players – 48.07±2.0 cm, of which 48.05±2.0 cm for boys and 48.02±2.0 cm for girls and the smallest in tennis players – 45.70±2.0 cm, of which 45.45±2.0 cm for boys and 45.30±2.0 cm for girls.

Considering the data of our study, we can conclude that sports selection considers such morphological features as total and partial body sizes, body proportions, and body weight composition.

Almost no works are explicitly devoted to studying thigh circumference parameters for sports fitness. We took into account the scientific achievements of authors such as Sara Jane Cullen and others, who, studying the anthropometric profiles of elite athletes, concluded that there are discrepancies in the anthropometric profiles between different athletes and different sports. This highlights the need to have sport-specific regulatory ranges available to ensure optimal monitoring of individual athletes, who differ particularly between sports, as well as age, training status [5].

Kotko D.M. and others studied changes in some anthropometric parameters in track and field athletes at the stages of long-term training, including the Kettle weight-growth index, the relative amount of muscle tissue, and the absolute amount of the bone component of the body [2].

Pastukhova V. studied the anthropometric data of track and field athletes at various stages of training and revealed the dependence of the sports achievements of track and field athletes of different qualifications on their anthropometric data. As a result, it was established that the competitive impact of track and field athletes depends mainly on physical characteristics and anthropometric parameters.

In our opinion and the opinion of other researchers, the very solution to selection problems involves the creation of a model of an athlete of a given specialization, that is, a particular set of characteristics that determine sports performance [1, 5, 8].

As a result of our research, it became possible to derive a model for predicting the proximal thigh circumference on the right and left, depending on the sport.

The model for predicting the proximal thigh circumference on the right has the form $y = \beta_1 + \beta_2 + 0.454 * x_1 - 0.203 * x_2$, where y – thigh circumference proximal to the right, x_1 – weight, x_2 – height. Coefficient $\beta_1 = 61.723$ for girls and $\beta_1 = 57.701$ for boys. Coefficient $\beta_2 = 0$ for the "basketball" group, $\beta_2 = -3.431$ for the "control" group, $\beta_2 = 0.370$ for the "football" group, $\beta_2 = -2.012$ for the tennis group, $\beta_2 = -0.789$ for the "volleyball" group. The coefficient of determination is 0.996.

The model for predicting the proximal circumference of the left thigh has the form $y = 0.192 * x_1 + 0.203 * x_2$, where y – thigh circumference proximal to the left x_1 – weight, x_2 – height. The coefficient of determination is 0.988.

It was also found that there is a significant difference in the average value of the length of the proximal circumference of the left and right thighs $t (254.55) = 5.382$, $p < 0.05$

Therefore, there is a need to define further anthropometric parameters for specific sports evaluated by standardised methods to ensure optimal monitoring and forecasting for sports selection.

Conclusions

1. Comparison of the length of the proximal circumference of the right and left thighs between boys and girls of both groups shows that the average difference among the studied students is not very noticeable: the main group – in young men, the circumference of the right thigh is 52.00±2.0 cm, the left thigh is 48.64±2.0 cm; in girls on the right – 52.29±2.0 cm; on the left – 53.43±2.0 cm, the control group

– in young men, the circumference of the right thigh is 53.09±2.0 cm, left thigh – 49.19±2.0 cm; in girls on the right – 50.05±2.0 cm; on the left – 46.73±2.0 cm.

2. Comparison of the length of the proximal circumference of the right and left thighs of students of the main group shows that the length of the proximal circumference of the right thigh of boys and girls is greater than that of the left (thigh circumference on the right in boys – 52.00±2.0 cm, on the left – 48.64±2.0 cm; in girls on the right – 52.29±2.0 cm; on the left – 48.00±2.0 cm).

3. Comparison of the length of the proximal circumference of the right and left thighs of boys and girls of the control group shows that the length of the proximal circumference of the right thigh of boys and girls is greater than the left (thigh circumference on the right in boys – 53.09±2.0 cm, on the left – 49.19±2.0 cm; in girls on the right – 50.05±2.0 cm; on the left – 46.73±2.0 cm).

4. By comparison, basketball players have the greatest length of the proximal circumference of the right thigh – 54.14±2.0 cm, of which 54.06±2.0 cm for boys and 54.08±2.0 cm for girls and volleyball players – 54.00±2.0 cm, of which 53.10±2.0 cm for boys and 53.90±2.0 cm for girls, slightly smaller in football players – 52.27±2.0 cm, of which 51.80±2.0 cm for boys and 52.47±2.0 cm for girls and the smallest tennis player – 48.80±2.0 cm, of which 48.10±2.0 cm for boys and 48.70±2.0 cm for girls.

5. By comparison, volleyball players have the greatest length of the left thigh circumference – 51.77±2.0 cm, of which 51.57±2.0 cm for boys and 51.20±2.0 cm for girls and basketball players – 50.00±2.0 cm, of which 50.20±2.0 cm for boys and 49.80±2.0 cm for girls, slightly smaller in football players – 48.07±2.0 cm, of which 48.05±2.0 cm for boys and 48.02±2.0 cm for girls and the smallest in tennis players – 45.70±2.0 cm, of which 45.45±2.0 cm for boys and 45.30±2.0 cm for girls.

6. The model for predicting the proximal thigh circumference on the right has the form $y = \beta_1 + \beta_2 + 0.454 \cdot x_1 - 0.203 \cdot x_2$, where y – thigh circumference is proximal to the right, x_1 – weight, x_2 – height. Coefficient $\beta_1 = 61.723$ for girls and $\beta_1 = 57.701$ for boys. The model for predicting the proximal thigh circumference on the left is: $y = 0.192 \cdot x_1 + 0.203 \cdot x_2$, where y – thigh circumference on the left x_1 – weight, x_2 – height.

References

1. Karatieieva SYu, Slobodian OM, Moseychuk YuYu, Lavriv LP, Baidiuk MYu, Goy RS. Osoblyvosti pokaznykiv ekskursiyi ohruddia v studentiv zakladiv vyshchoyi osvity. Klinichna anatomiya ta operatyvna khirurhiya. Chernivtsi. 2021; 20, 2 (76):14 – 24. DOI: 10.24061/1727-0847.20.2.2021.14 [in Ukrainian]

2. Kotko DM, Honcharuk NL, Shevtsov SM. Zminy deiakykh antropometrychnykh pokaznykiv u sportsmeniv – lehkoatletiv na etapakh bahatorichnoi pidhotovky. Naukovyi chasopys NPU imeni N.P. Drahomanova. Kyiv. 2021; 3(133): 68–73. [in Ukrainian]

3. Shaparenko PF. Antropometriia. Vinnytsia: Drukarnia Vinnytskoho derzhavnoho medychnoho universytetu im. M.I. Pyrohova, 2000: 71 s. [in Ukrainian]

4. Aragon AA, Schoenfeld BJ, Wildman R, Kleiner S, Van Dusseldorp T, Taylor L, et.al. International society of sports nutrition position stand: diets and body composition. J Int Soc Sports Nutr. 2017 Jun 14;14:16. doi: 10.1186/s12970-017-0174-y.

5. Cullen S, Fleming J, Logue DM, O'Connor J, Connor B, Cleary J. Anthropometric profiles of elite athletes. J of Human Sport & Exercise. 2020; 17 (1): 145–155. doi:10.14198/jhse.2022.171.14

6. Danielle L, Sharon M, Eamonn D, Miriam H, Sarah J, Clare A. Low Energy Availability in Athletes: A Review of Prevalence, Dietary Patterns, Physiological Health, and Sports Performance. Sports Medicine. 2018; 48 (1): 73–96. doi:10.1007/s40279-017-0790-3.

7. Josu G, Nicholas T, Jon T, Cristina G, Jordan S. Anthropometric characteristics of top-class Olympic race walkers. J of Sports Medicine and Physical Fitness. 2019; 59(3): 429–433. doi:10.23736/S0022-4707.18.08363-9.

8. Karatieieva SYu, Slobodian OM, Honchar HI, Nazarevych VS, Slobodian KV, Korelianchuk AV. Establishment of types of the constitutions in students-athletes and in students-medicists with their further analysis. Wiadomosti Lekarskie 2022; LXXV, 4(2):955–959. doi: 10.36740/WLek20220420106.

9. Kozina ZhL, Bazilyuk TA, Boyko AG. Analysis of the structure of the integrated preparedness of qualified handballers using multidimensional analysis methods. Health, sport, rehabilitation. 2017; 3(2): 15–24. doi:10.34142/zenodo.1109904.

10. Kristina L, David H, Parker N, Abbie E, Jordon R, Jeffrey R. Estimating fat-free mass in elite-level male rowers: a four-compartment model validation of laboratory and field methods. Journal of Sports Science. 2017; 35(7): 624–633 doi:10.1080/02640414.2016.1183802.

11. Logue D, Madigan SM, Delahunt E, Heinen M, Mc Donnell SJ, Corish CA. Low Energy Availability in Athletes: A Review of Prevalence, Dietary Patterns, Physiological Health, and Sports Performance. Sports Med. 2018;48(1):73–96. PMID: 28983802. doi: 10.1007/s40279-017-0790-3.

12. Ratko Pavlović, Ilona Mihajlović, Nikola Radulović, Siniša Nikolić. Anthropometric parameters of elite male runners sprint: are body height and body weight good predictors of results. Health, sport, rehabilitation, 2022; 8(3): 64–74 doi: 10.34142/HSR.2022.08.03.05.

13. Sogokon OA, Donets OV, Donets IM.Functional state of cardiovascular and digestive systems in the body of students during fitness training. World of Medicine and Biology. 2020; 1 (71): 136–141. doi: 10.26724/2079-8334-2020-1-71-136-141.

14. Thomas D, Erdman K, Burke L. American College of Sports Medicine joint position statement. Nutrition and athletic performance. Medicine and Science in Sports and Exercise. 2016; 48(3): 543–568 doi:10.1249/MSS.0000000000000852.

15. Vesnina LE. Boriak KhR, Sokolenko VM. Assesment of the dietary energy intake of young people with normal weight and overweight. World of Medicine and Biology. 2020;3 (73): 27–32. doi: 10.26724/2079-8334-2020-3-73-27-32.