

Anatolij Gierasiewicz\*

## SOMATIC DIVERSITY AMONG UNIVERSITY STUDENTS IN THE REPUBLIC OF BELARUS

### Introduction

The research on university students in the Republic of Belarus focuses on the assessment of their physical and motor development, the characteristics of the indexes of body proportions, body composition, their endurance, the dynamics of changes in morphofunctional features and health. There are numerous studies of materials collected among students doing humanities and engineering courses, however, there are fewer works on the assessment of the somatic features of young people doing courses with diversified physical activity classes (for example, Adamovich 1976; Chernozub 2011; Panjukov 2011; Gerasevich 2013, 2016, 2017; Uljanov 2014).

Young people come from various backgrounds that differ in their social compositions, and the results of the research can forecast the professional effects after graduating from university.

Each university, depending on the teaching profile, sets specific requirements for their students. The selection is particularly demanding for physical education students. Intensive sports classes, which are compulsory for PE students, as well as additional trainings are important factors affecting changes in their body shape. This paper presents the comparative characteristics of the physical development of university students in the Republic of Belarus in relation to diversified physical activity.

### Material and method

The material includes the results of the studies conducted among 374 male students and 414 female students of years three and four at the State University of Brest in 2011-2012 by the employees of the Department of Health

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\* **Anatolij Gierasiewicz** – Ph. D., Associate Professor, Department of Anthropology, Institute of History of the National Academy of Science Belarus (Minsk) and A.S. Pushkin's State University of Brest; scientific interests: ontogenetic anthropology, auxology, physical culture; ORCID: <https://orcid.org/0000-0003-4641-8341>; e-mail: [ger@tut.by](mailto:ger@tut.by)

and Physical Culture. Four groups were identified: two groups of physical education students and two groups of students doing other courses (humanities and engineering). Martin's technique (Martin, Saller 1957) was used to measure the length and width sections of the body, the circumferences, the thickness of skinfolds and body mass. Based on the measurements of the height and body mass, the BMI was calculated according to the formula:

$$\text{BMI} = (\text{body mass in kg} : \text{B-v in m}^2)$$

The material was analysed statistically by calculating the mean with its complements. The significance of differences between the means was assessed with Student's t-test. The sexual dimorphism of the tested groups was determined with Mollison's index.

Table 1

Numerical characteristics of somatic features of the studied groups of students in Brest

Feature/index	Physical education students N=352		Humanities and engineering students N=22		d
	M	SD	M	SD	
Height	178.81	7.43	179.38	6.81	-0.51
Body mass	76.2	10.42	72.84	9.96	3.36
Arm circumference	28.89	3.28	27.78	3.12	1.11
Forearm circumference	25.84	2.59	25.54	1.83	0.30
Thigh circumference	61.21	5.79	57.71	9.37	3.50**
Lower leg circumference	36.07	3.18	36.02	3.24	0.05
Chest circumference [rest position]	92.76	6.52	90.91	8.07	1.85
Chest circumference [inhalation]	98.57	6.07	95.73	8.00	2.84*
Chest circumference [exhalation]	90.31	5.62	88.32	7.66	1.99
Skinfold thickness over the triceps	9.92	4.68	12.52	6.05	-2.60*
Skinfold thickness over the biceps	5.58	3.34	7.19	5.41	-1.61
Skinfold thickness beneath the shoulder blade	11.87	5.16	12.43	5.42	-0.56
Abdominal skinfold thickness	15.37	8.02	18.48	8.32	-3.11
Skinfold thickness on the iliac crest	13.25	7.23	14.69	8.10	-1.44
Skinfold thickness on the lower leg	12.38	4.95	12.90	4.76	-0.52
The thickness of 6 skinfolds in total	68.23	28.37	78.21	34.20	-9.98
BMI	23.79	2.92	22.70	3.41	1.09

\* – significance at the 0.05 level; \*\* – significance at the 0.01 level

## Research results

As shown in Table 1, in comparison to their peers studying at other faculties of the same university, the students of physical education at the University of Brest are characterized by greater average body mass, greater circumferences of the arm, forearm, thigh, lower leg, chest (in rest position, during inhalation and exhalation), greater stoutness, lower height and smaller thickness of skinfolds (over the triceps, over the biceps, beneath the shoulder blade, on the abdomen, on the iliac crest, and the total thickness of 6 folds). Statistically significant differences between the means were noted in the circumference of the thigh, the chest circumference at maximum inhalation and the thicknesses of skinfolds over the triceps and the biceps. The comparisons of somatic features expressed in different units were presented in the form of normalized values to the mean ( $M = 0$ ) and standard deviation ( $s = 1$ ) in the PE students at the University of Brest. Based on the results of normalization, the largest differences were found in the thigh circumference and skinfold thickness over the triceps, which exceed the value of 0.5 standard deviation.

Table 2

Numerical characteristics of somatic features of the female students in Brest

Feature/index	Physical education students N=210		Humanities and engineering students N=204		d
	M	SD	M	SD	
Height	167.03	6.55	166.62	8.85	0.41
Body mass	60.65	9.46	58.62	8.85	2.03*
Arm circumference	25.06	3.07	25.00	2.85	0.06
Forearm circumference	22.14	2.25	22.03	2.17	0.11
Thigh circumference	60.21	8.02	55.99	6.40	4.22**
Lower leg circumference	35.75	4.82	34.86	2.88	0.89*
Chest circumference [rest position]	86.17	5.92	84.02	6.08	2.15**
Chest circumference [inhalation]	91.52	5.81	88.30	6.38	3.22**
Chest circumference [exhalation]	83.67	5.94	81.96	6.15	1.71**
Skinfold thickness over the triceps	16.62	5.97	18.72	5.52	-2.10**
Skinfold thickness over the biceps	9.33	4.36	9.88	4.18	-0.55
Skinfold thickness beneath the shoulder blade	12.84	4.73	14.28	5.84	-1.44**
Abdominal skinfold thickness	18.41	6.13	20.60	6.20	-2.19**
Skinfold thickness on the iliac crest	17.17	7.03	17.90	6.52	-0.73
Skinfold thickness on the lower leg	17.13	4.68	17.31	4.71	-0.18
The thickness of 6 skinfolds in total	91.41	26.51	98.69	27.35	-7.28**
BMI	21.66	2.85	21.08	2.92	0.58*

\* – significance at the 0.05 level; \*\* – significance at the 0.01 level

In comparison to their peers studying at other faculties of the same university, the female students of physical education at the University of Brest are characterized by greater average height and body mass, greater circumferences of the arm, forearm, thigh, lower leg, chest (in rest position, during inhalation and exhalation), greater stoutness, smaller thickness of skinfolds (over the triceps, biceps, beneath the shoulder blade, on the abdomen, on the iliac crest, over the lower leg and the total thickness of 6 folds). Statistically significant differences between the means were recorded in the body mass, the circumferences of the thigh, lower leg, chest (in rest position, at maximum inhalation and exhalation), thicknesses of skinfolds over the triceps, beneath the shoulder blade, on the abdomen, the total thickness of 6 folds, and the BMI (Table 2). Based on the results of normalization, the largest differences were found in the thigh and chest circumferences at maximum inhalation, which exceed the value of 0.5 standard deviation.

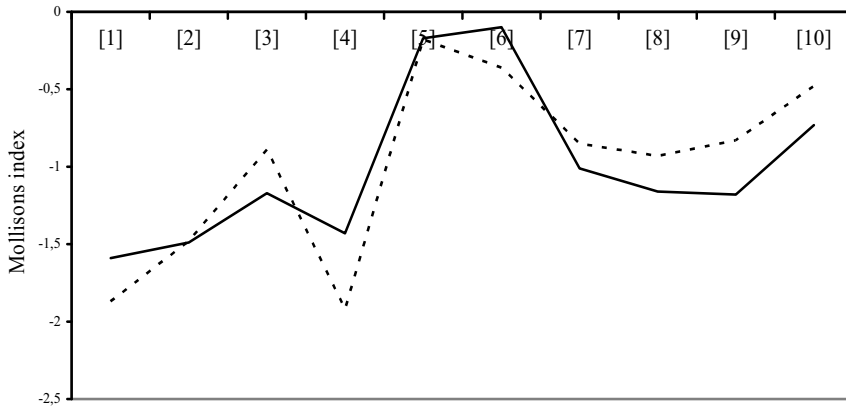
Table 3

Sexual dimorphism of somatic features in the students of physical education in Brest

Feature/index	Male students N=352		Female students N=210		d
	M	SD	M	SD	
Height	178.81	7.43	167.03	6.55	11.78**
Body mass	76.20	10.42	60.65	9.46	15.55**
Arm circumference	28.89	3.28	25.06	3.07	3.83**
Forearm circumference	25.84	2.59	22.14	2.25	3.70**
Thigh circumference	61.21	5.79	60.21	8.02	1.00
Lower leg circumference	36.07	3.18	35.75	4.82	0.32
Chest circumference [rest position]	92.76	6.52	86.17	5.92	6.59**
Chest circumference [inhalation]	98.57	6.07	91.52	5.81	7.05**
Chest circumference [exhalation]	90.31	5.62	83.67	5.94	6.64**
Skinfold thickness over the triceps	9.92	4.68	16.62	5.97	-6.70**
Skinfold thickness over the biceps	5.58	3.34	9.33	4.36	-3.75**
Skinfold thickness beneath the shoulder blade	11.87	5.16	12.84	4.73	-0.97*
Abdominal skinfold thickness	15.37	8.02	18.41	6.13	-3.04**
Skinfold thickness on the iliac crest	13.25	7.23	17.17	7.03	-3.92**
Skinfold thickness on the lower leg	12.38	4.95	17.13	4.68	-4.75**
The thickness of 6 skinfolds in total	68.23	28.37	91.41	26.51	-23.18**
BMI	23.79	2.92	21.66	2.85	2.13**

\* – significance at the 0.05 level; \*\* – significance at the 0.01 level

Tables 3-4 present the characteristics of somatic features of the students from the dimorphic perspective. As shown in Table 3, in comparison to their female peers, the male students of physical education are distinguished by significantly greater height, greater body mass, greater circumferences of the arm, forearm, chest and stoutness, smaller thicknesses of skinfolds (over the triceps, over the biceps, beneath the shoulder blade, on the abdomen, on the iliac crest, over the lower leg and the total thickness of 6 folds). The greatest dimorphism in the compared features was noted in the height and body mass, the circumferences of the forearm, the thickness of the skinfold over the triceps, and the smallest dimorphism was recorded in the circumference of the lower leg (Figure 1).



— Physical education students; ····· Humanities and engineering students

[1] – height; [2] – body mass; [3] – arm circumference; [4] – forearm circumference; [5] – thigh circumference; [6] – lower leg circumference; [7] – chest circumference (rest position); [8] – chest circumference at inhalation; [9] – chest circumference at exhalation; [10] – BMI

Figure 1. Dimorphism of selected somatic features and the BMI in the compared groups.

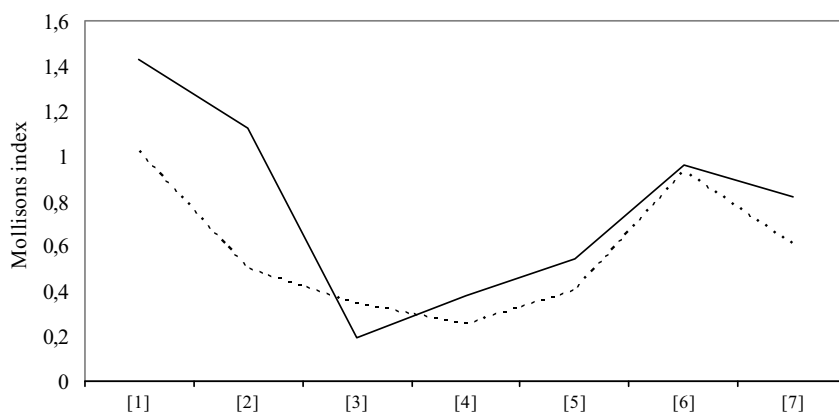
Table 4

Sexual dimorphism of somatic features in the students of humanities and engineering in Brest

Feature/index	Male students N=22		Female students N=204		d
	M	SD	M	SD	
	Height	179.38	6.81	166.62	
Body mass	72.84	9.96	58.62	8.85	14.72**
Arm circumference	27.78	3.12	25.00	2.85	2.78**
Forearm circumference	25.54	1.83	22.03	2.17	3.51**
Thigh circumference	57.71	9.37	55.99	6.40	1.72
Lower leg circumference	36.02	3.24	34.86	2.88	1.16
Chest circumference [rest position]	90.91	8.07	84.02	6.08	6.89**
Chest circumference [inspiration]	95.73	8.00	88.30	6.38	7.43**
Chest circumference [exhalation]	88.32	7.66	81.96	6.15	6.36**
Skinfold thickness over the triceps	12.52	6.05	18.72	5.52	-6.20**
Skinfold thickness over the biceps	7.19	5.41	9.88	4.18	-2.69**
Skinfold thickness beneath the shoulder blade	12.43	5.42	14.28	5.84	-1.85
Abdominal skinfold thickness	18.48	8.32	20.60	6.20	-2.12
Skinfold thickness on the iliac crest	14.69	8.10	17.90	6.52	-3.21*
Skinfold thickness on the lower leg	12.90	4.76	17.31	4.71	-4.41**
The thickness of 6 skinfolds in total	78.21	34.20	98.69	27.35	-20.48**
BMI	22.70	3.41	21.08	2.92	1.62*

\* – significance at the 0.05 level; \*\* – significance at the 0.01 level

As shown in Table 4, in comparison to their male peers, the male students of humanities and engineering are characterized by significantly greater height and body mass, greater circumferences of the arm, forearm, chest (in rest position, at inhalation and exhalation), stoutness and smaller thickness of skinfolds over the triceps, the biceps, the iliac crest, the lower leg and the total thickness of 6 folds. The largest dimorphism in the compared features was noted in the circumference of the forearm, height and body mass, while the smallest dimorphism was recorded in the circumference of the thigh and lower leg (Figure 2).



— Physical education students; ····· Humanities and engineering students

[1] – over the triceps; [2] – over the biceps; [3] – beneath the shoulder blade; [4] – on the abdomen; [5] – over the iliac crest; [6] – over the lower leg; [7] – total thickness of 6 skinfolds

Figure 2. Dimorphism of the thickness of skinfolds of the compared groups.

## Discussion

The presented analysis of the research results indicates a clear differentiation of somatic features and the body proportions of students of the State University of Brest. The obtained results confirm the observations of other authors (Tatarczuk 2006; Czarny 2007; Grzesiak 1999; Rodziejewicz-Gruhn, Połacik 2014; Asienkiewicz, Wandycz 2017; Wandycz, Asienkiewicz, 2018).

In comparison to their peers studying humanities and engineering, the students of physical education in Brest are distinguished by, on average, greater body mass, greater circumferences of the arm, forearm, thigh, lower leg and chest, and smaller thickness of skinfolds. The physical education students are also characterized by greater stoutness. Moreover, the female students of physical education are taller than their peers.

Assessing the dimorphism in the compared groups, a greater differentiation was noted in the height and body mass, the circumferences of the arm, forearm, thigh, lower leg and the thicknesses of skinfolds among the students of humanities and engineering, and a greater differentiation was recorded in the chest circumferences among the students of physical education. It should be emphasized that the occurring differences indicate a different eco-sensitivity of both sexes to environmental factors.

## Conclusions

1. In comparison to their peers studying humanities and engineering at the State University of Brest, the male students of physical education are distinguished by significantly greater circumferences of the thigh and chest at maximum inhalation, and smaller thicknesses of skinfolds over the triceps and the biceps.
2. In comparison to their peers studying humanities and engineering, the female students of physical education are significantly heavier, have greater circumferences of the thigh, the lower leg, and the chest (in rest position, at maximum inhalation and exhalation), and they have smaller thicknesses of skinfolds (over the triceps, beneath the shoulder blade, on the abdomen, a total thickness of 6 folds), and lower BMIs
3. In comparison to the students of humanities and engineering, the male and female students of physical education at the State University of Brest are characterized by a stouter body build with a statistically significant difference among the female students.
4. A greater dimorphism of somatic features was noted among the students of physical education.

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Anatolij Gierasiewicz

## SOMATIC DIVERSITY OF STUDENTS IN THE REPUBLIC OF BELARUS

**Keywords:** academic students, physical development, comparative characteristics.

The paper attempts to assess the development of somatic features in students whose study programs include diversified physical activity.

The research was carried out in 2011-2012 among 788 male and female students of the years three and four of physical education, humanities, and engineering at the State University of Brest. Martin's technique was used to measure body lengths, widths, circumferences, skinfolds, and body mass. The material was analyzed statistically. Sexual dimorphism was determined with Mollison's index.

On the basis of the statistical analysis, a clear diversity among the students was found. In comparison to their peers studying humanities and engineering, the students of physical education are characterized by a significantly greater body mass (women students), smaller thickness of subcutaneous fat, and greater circumferences. They are also distinguished by a stouter body build. A greater dimorphism of somatic features was found among the students of physical education.

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## ZRÓŻNICOWANIE CECH SOMATYCZNYCH STUDENTÓW REPUBLIKI BIAŁORUSI

**Słowa kluczowe:** młodzież akademicka, rozwój fizyczny, charakterystyka porównawcza.

Celem prezentowanej pracy jest ocena poziomu wykształcenia cech somatycznych młodzieży kształcącej się na kierunkach o zróżnicowanej w programach studiów aktywności ruchowej. Badania zostały przeprowadzone w latach 2011-2012 wśród 788 studentów i studentek III i IV roku wychowania fizycznego oraz kierunków humanistycznych i technicznych Państwowego Uniwersytetu w Brześciu. Technika martinowską wykonano pomiary odcinków długościowych, szerokościowych, obwodów, fałdów skórno-tłuszczowych oraz masy ciała. Materiał opracowano statystycznie. Dymorfizm płciowy określono wskaźnikiem Mollisona.

Na podstawie przeprowadzonej analizy statystycznej stwierdzono wyraźne zróżnicowanie młodzieży porównywalnych kierunków studiów. Studenci wychowania fizycznego w porównaniu z rówieśnikami kierunków humanistycznych i technicznych charakteryzują

się istotnie większą masą ciała (studentki) oraz większymi obwodami, natomiast mniejszą podściółką tłuszczową. Wyróżnia ich także cięższa budowa ciała. Większy dymorfizm cech somatycznych odnotowano wśród młodzieży kształcącej się na kierunku wychowanie fizyczne.