

## COMPARATIVE CHARACTERISTICS OF THE SEPARATE MORPHOLOGICAL AND FUNCTIONAL STATE INDICATORS OF THE ORGANISM OF MODERN STUDENTS (PART 1)

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**Annotation.** The goal of paper was to conduct a complex assessment of morphofunctional state of the students' organism (male and female) of various faculties, who are learning at the 3-4-courses (full-time and distance learning). The examination involved 1,160 students (972 male and 988 female). Identified the differences between the students of the Faculty of Physical Education (FPE) and other faculties (full-time learning). Significant differences are obtained mainly in the female group. In the group of young men were observed only trends of differences, but in a group of girls female students of FPE had greater weight, a greater of chest circumference in pause, on inspiratory and expiratory, chest excursion, thickness of skinfolds (TSF) over the triceps muscle, under the scapula, on abdomen and the total of TSF. The girls from other faculties had the biggest percentage of body fat and lower in body water compared with boys of similar faculties. Results are useful as a regulatory framework for medical and pedagogical control of the students health, they may be of interest to other researches in the comparative aspects.

**Keywords:** students, courses, morphological, indexes.

### Introduction

Physical development is determined as a complex of morphological and functional indicators characterising the level of biological development and physical performance at a certain stage of human ontogeny (Karpman, 1987). The main factors that determine the level of physical development and above all its main morphological parameters (length and body weight, the value of skin folds, etc.), are:

1) genetic factors, 2) the nature and quality of nutrition, 3) living conditions (ecological, geographical, climatic, etc.), 4) the quality of life (income, work type, activities, etc.), 5) the level of physical activity and others [16, 19].

The level of physical development (PD) is an important component in determining the health of the university students [1, 9, 18]. Also actual for the student's age are the researches, devoted to the problems of the regional characteristics of the PD [2, 3, 5, 8, 14], the level of indicators of PD in representatives of different nationalities of Russia [11], relationships between morphological, functional indicators and motor performance [13, 17], the component body composition [10, 15]. Since by the period of the second half of the students age (3-4th courses), the main indicators of the PD have been stabilized, the processes of the somatotype formation are finished [8, 9], the relative stabilization of the health level of young men and women can be assumed.

Recently have been spread the methods of monitoring research of the health level in the following areas of activity with actual measurements: physical development, functional training and physical fitness.

Such studies are innovative in the sphere of health saving technology use at the stage of improvement of modern education. They let professors (teachers) and students to gain the knowledge and skills necessary for conducting a systematic and continuous monitoring and evaluation of the received health indicators. Monitoring studies become more common in different cohorts of surveyed (eg, Izaak S.I., 2006; Levushkin S.P. et al., 2012).

The result of work in this direction are the tables of physical development reflecting the average level of population status in many indicators that is the result of research by many authors from different regions of Russia, Poland, Ukraine and other countries. For Belarus the material reflecting the level of physical development of school children and youth of the country, including only separate groups of student age is updated (eg, L.I. Tegako et al., 2008; S.A. Lyalikov, S.D. Orehov, 2009). Level of indicators morphofunctional state of youth of student age for the Brest region in recent years is absent and update these results every 5-10 years is very important.

The work has been finished in according with the plan of research in Brest State University (BrSU) named after A.S. Pushkin (for the needs of the University).

### The goal, the tasks, materials and methods.

*The goal* was to conduct a comprehensive assessment of morphological and functional state of the students organism (male and female) of various faculties learning on the 3-4-courses of university (full-time and distance learning).

*Methods and organization of the study.* The material presented here is a part of a study conducted on 1160 students (572 boys and 588 girls) of 3th and 4th courses of the faculty of physical education (FPE, n = 934) and other faculties (n = 226) as social and pedagogical, geographical, philological and foreign languages of BrSU named after A.S.Pushkin aged 19-23 years (full-time learning) and 20-30 years (distance learning). The survey period: 2011-2012. The results were processed by the methods of mathematical statistics and presented in the form: mean value (X), error of the mean ( $\pm m$ ), standard deviation ( $\sigma$ ), minimum ( $X_{\min}$ ) and maximum value ( $X_{\max}$ ). The significance of differences between the results determined using the Student t-test.

To obtain the results shown in the work the next equipment were used: a set of tools for anthropometric measurements (accuracy of length and circumference measurement of the body - 1 mm), to measure the thickness of

skin folds (TSF) - Lange caliper, to determine the mass (precision of measurement - 0.1 kg) and component composition of the body - electronic scales analyzer «Tanita BC-543" (Japan).

**The results of the research.**

It is known that a long period of physical training and sports in general the affect specific manner influences the morphological and functional state of the body. The degree of the physical exertion during training at the university is different in different faculties, it is especially high on specialized FPE. Students in the lectures of practical subjects - sports (football, basketball, volleyball, handball), track and field, gymnastics, swimming and other - have a high level of physical activity almost during courses of study. Students of other faculties (philology, social and pedagogical, foreign languages, etc.) perform physical activities mainly during the mandatory training 2 times a week during all the years of learning.

The results presented in the paper are discussed in the aspect of the differences between the students of a specialized faculty (physical education, FPE) and other faculties not associated with active physical training and sports (PTS).

The analysis of the results allowed us to identify the following. In the groups of young man and women had not been detected a large number of significant differences in the weight and length of the body (standing and sitting) between the mean values of FPE students and students of other faculties (Table 1).

Table 1

*The mean values of body weight and length (standing and sitting) of young men and women, students of faculty of physical education (FPE) and other faculties (OF) (3-4th courses, full-time learning)*

| Groups of students | Weight, kg      |          |                                      | Length standing , cm |          |                                      | Length sitting, cm |          |                                      |
|--------------------|-----------------|----------|--------------------------------------|----------------------|----------|--------------------------------------|--------------------|----------|--------------------------------------|
|                    | $\bar{X} \pm m$ | $\sigma$ | X <sub>min</sub><br>X <sub>max</sub> | $\bar{X} \pm m$      | $\sigma$ | X <sub>min</sub><br>X <sub>max</sub> | $\bar{X} \pm m$    | $\sigma$ | X <sub>min</sub><br>X <sub>max</sub> |
| Young men          |                 |          |                                      |                      |          |                                      |                    |          |                                      |
| FPE<br>(n = 352)   | 76,20<br>±0,56  | 10,42    | 50,9<br>114,0                        | 178,81<br>±0,42      | 7,43     | 145,0<br>198,0                       | 95,75<br>±0,30     | 5,24     | 76,8<br>113,8                        |
| OF<br>(n = 22)     | 72,84<br>±2,12  | 9,96     | 57,0<br>97,5                         | 179,38<br>±1,45      | 6,81     | 163,0<br>193,0                       | 94,36<br>±0,77     | 3,61     | 85,0<br>101,5                        |
| Yong women         |                 |          |                                      |                      |          |                                      |                    |          |                                      |
| FPE<br>(n = 210)   | 60,65<br>±0,65  | 9,46     | 43,0<br>100,8                        | 167,03<br>±0,46      | 6,55     | 142,0<br>182,0                       | 88,87<br>±0,34     | 4,73     | 74,0<br>100,0                        |
| OF<br>(n = 204)    | 58,52*<br>±0,62 | 8,85     | 36,8<br>96,1                         | 166,62<br>±0,44      | 6,25     | 152,5<br>182,0                       | 89,47<br>±0,23     | 3,34     | 81,0<br>100,0                        |

Note. \*- P<0.05 - significance of differences between the results in a group of girls

In general there is a trend to higher values of the indicators in both sex groups and in body weight in girls - significantly more value - at the students FPE compared with students from other faculties (difference - 2.13 kg, P<0.05). Perhaps the lack of differences in the length of the body reflects more expressed influences of genetic factors on the total size of the body comparing with phenotypic (eg, high levels of physical activity) at all other things being equal.

In the girth sizes of the body (chest circumference (CC) on the inhale, exhale and in pause as well as of the chest excursion (CE) in the group of young men manifested tendency but in the group of women - a significant excess of the mean values of FPE girls compared with girls of other faculties (P<0.01-0.001, Table 2).

More detailed the mean values in a group of girls differed by: CC on pause - 2.15 cm, on the inhale - by 3.22 cm, on the exhale - 1.71 cm (for all, P<0.01), in CE - 1.31 cm (P<0.001). Received significant differences likely reflect the degree of influences of the long-term PTS the emerging female somatotype, in the picture is present the characteristics of masculinity (broad chest).

Table 2

The mean values of chest circumference (on pause, inhale and exhale) and excursion in boys and girls, students of the faculty of physical education (FPE) and other faculties (OF) (3-4th courses, full-time learning)

| Groups of students | Chest circumference, cm |          |                          |                     |          |                          |                     |          |                          | Chest excursion, cm |          |                          |
|--------------------|-------------------------|----------|--------------------------|---------------------|----------|--------------------------|---------------------|----------|--------------------------|---------------------|----------|--------------------------|
|                    | pause                   |          |                          | inhale              |          |                          | exhale              |          |                          | $\bar{X} \pm m$     | $\sigma$ | $X_{\min}$<br>$X_{\max}$ |
|                    | $\bar{X} \pm m$         | $\sigma$ | $X_{\min}$<br>$X_{\max}$ | $\bar{X} \pm m$     | $\sigma$ | $X_{\min}$<br>$X_{\max}$ | $\bar{X} \pm m$     | $\sigma$ | $X_{\min}$<br>$X_{\max}$ |                     |          |                          |
| Young man          |                         |          |                          |                     |          |                          |                     |          |                          |                     |          |                          |
| FPE<br>(n = 352)   | 92,76<br>$\pm 0,35$     | 6,52     | 68,8<br>117,0            | 98,57<br>$\pm 0,33$ | 6,07     | 87,0<br>121,2            | 90,31<br>$\pm 0,30$ | 5,62     | 77,6<br>113,0            | 8,26<br>$\pm 0,16$  | 2,89     | 3,0<br>18,0              |
| OF<br>(n = 22)     | 90,91<br>$\pm 1,72$     | 8,07     | 78,0<br>112,0            | 95,73<br>$\pm 1,71$ | 8,00     | 81,0<br>116,0            | 88,32<br>$\pm 1,63$ | 7,66     | 77,0<br>108,0            | 90,91<br>$\pm 1,72$ | 2,31     | 3,0<br>13,0              |
| Young women        |                         |          |                          |                     |          |                          |                     |          |                          |                     |          |                          |
| FPE<br>(n = 210)   | 86,17<br>$\pm 0,41$     | 5,92     | 71,2<br>111,0            | 91,52<br>$\pm 0,40$ | 5,81     | 80,0<br>117,0            | 83,67<br>$\pm 0,41$ | 5,94     | 67,0<br>109,0            | 7,85<br>$\pm 0,15$  | 2,14     | 4,0<br>16,0              |
| OF<br>(n = 204)    | 84,02<br>$\pm 0,43$     | 6,08     | 68,0<br>106,0            | 88,30<br>$\pm 0,45$ | 6,38     | 70,0<br>112,0            | 81,96<br>$\pm 0,43$ | 6,15     | 66,0<br>103,0            | 6,54<br>$\pm 0,15$  | 2,07     | 2,0<br>13,0              |

Note. \*\*-  $P < 0.01$ , \*\*\*-  $P < 0.001$  - significance of differences between the results in a group of girls

On the thickness of skin folds (TSF) in the group of young men there is a trend of higher mean values for those not actively engaged in PTS, as in some areas, as on the sum of TSF (FPE - at the level of  $68.23 \pm 1.57$  mm, other faculties - at the level

of  $78.21 \pm 7.46$  mm; figure 1, 2). In the group of female such trends were stronger and led to the emergence of female students of other faculties significantly higher values of FSF on triceps muscle (at 2.10 mm,  $P < 0.001$ ), under the angle of scapula (1.44 mm,  $P < 0.01$ ), on abdomen (2.19 mm,  $P < 0.001$ ), and the sum of TSF (mean values at female students of FPE -  $91.41 \pm 1.88$  mm, other faculties -  $98.69 \pm 1.92$  mm, the difference - 7.28 mm,  $P < 0.01$ ).

Currently when female students during their studies addiction can manifest as a bunch of an extra weight (or obesity) and enhanced reduction of it (sometimes to the point of anorexia) obtained mean values of TSF as well as the differences obtained on the triceps muscle, under the angle of scapula, on the abdomen and on the sum of TSF can be considered as important indicators for monitoring the level of the distribution of subcutaneous fat.

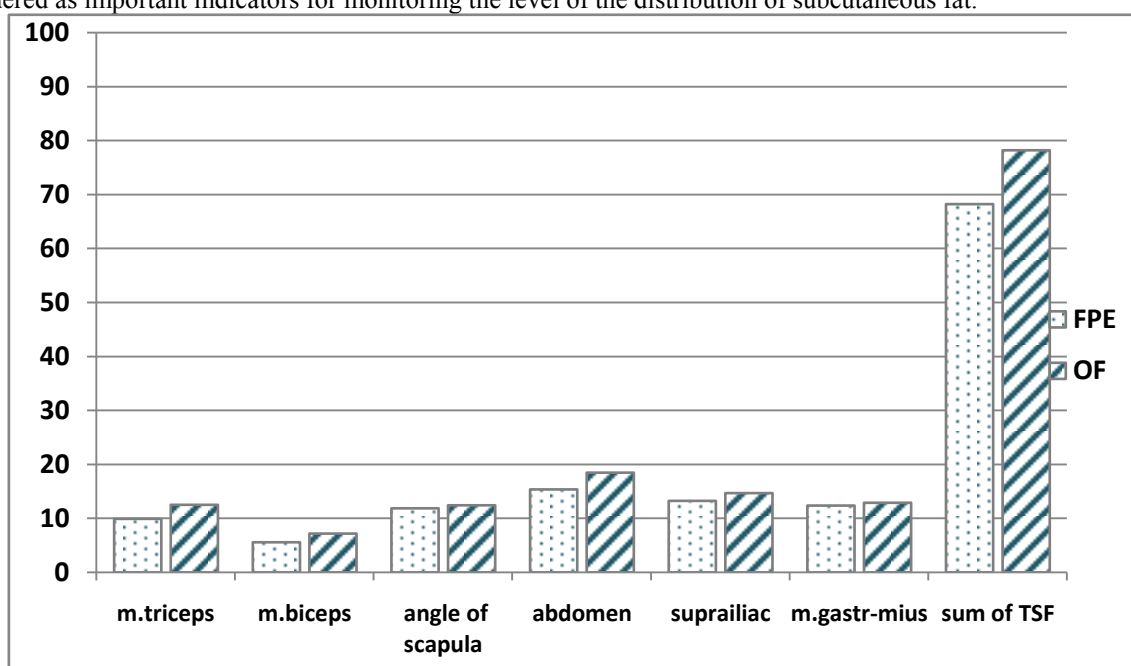
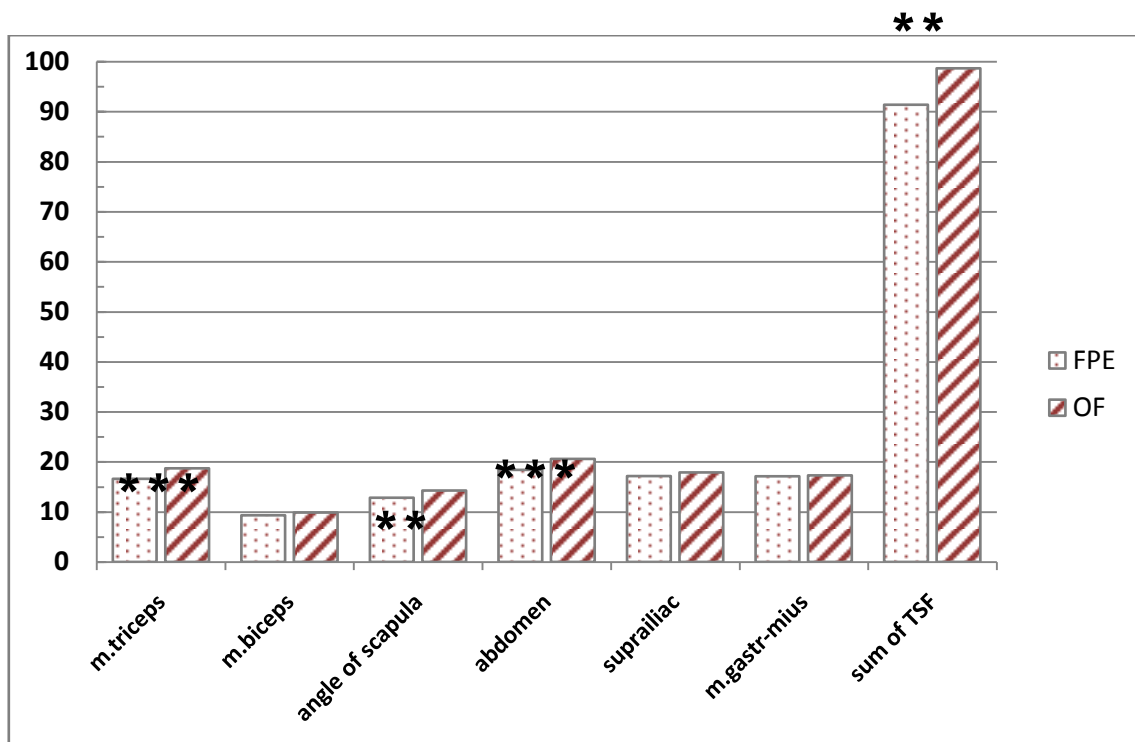


Figure 1. The mean values of the thickness of skin folds of male students at 3-4th courses studying on the faculty of physical education (FPE) and other faculties (OF)



Note. \*\* - P<0.01, \*\*\* - P<0.001 - significance of differences between the results in a group of girls

Figure 2. The mean values of the thickness of skin folds of female students at 3-4th courses studying on the faculty of physical education (FPE) and other faculties (OF)

Together with the definition of the TSF it seemed interesting to determine the level of the individual components of body composition - fat and water in the body of students (Table 3).

Table 3

The percentage of fat and water in the body of young man and women studying in the 3-4th courses of the faculty of physical education (FPE) and other faculties (OF)

| Groups of students | Fat content, %                              |          |                        | Water content, %                            |          |                        |
|--------------------|---|----------|------------------------|---|----------|------------------------|
|                    | $\bar{X} \pm m$                             | $\sigma$ | $X_{min}$<br>$X_{max}$ | $\bar{X} \pm m$                             | $\sigma$ | $X_{min}$<br>$X_{max}$ |
| Young man          |   |          |                        |   |          |                        |
| FPE<br>(n = 352)   | 14,69<br>$\pm 0,21$                         | 3,94     | 6,0<br>28,4            | 59,44<br>$\pm 0,23$                         | 4,30     | 25,1<br>69,2           |
| OF<br>(n = 22)     | 14,80<br>$\pm 1,24$                         | 5,83     | 8,0<br>32,1            | 59,46<br>$\pm 0,82$                         | 3,82     | 50,7<br>66,2           |
| Young women        |   |          |                        |   |          |                        |
| FPE<br>(n = 210)   | 23,88<br>$\pm 0,45$<br>$\Delta\Delta\Delta$ | 6,54     | 7,1<br>43,8            | 53,53<br>$\pm 0,28$<br>$\Delta\Delta\Delta$ | 4,07     | 41,0<br>62,0           |
| OF<br>(n = 204)    | 23,71<br>$\pm 0,48$<br>$\Delta\Delta\Delta$ | 6,84     | 7,4<br>52,1            | 53,38<br>$\pm 0,37$<br>$\Delta\Delta\Delta$ | 5,18     | 25,1<br>68,1           |

Note.  $\Delta\Delta\Delta$  - P<0.001 - significance of differences between groups of young men and women from similar faculties

As a result of the studies with the use of a bioimpedance-metrical method (scales analyzers) have been found out differences were found in largely on the sexual features of the distribution of adipose tissue and water in the body of male and female. Young man had lower values in the body of adipose tissue (14.69-14.80%) as larger (59.44-59.46%) - of water compared with young women of similar faculties (P<0.001). However, the impact of systematic PTS training not affected on the level of these indicators in the body of the surveyed students. No significant differences between groups of students from different faculties (FPE and others) have been discovered. Perhaps that obtained and described

above differences on TSF in group of female are compensated redistribution of body fat and water in the internal organs are the evidence about change in the topography of the distribution of adipose tissue in the subcutaneous layer, related to the influence of active PTS.

Results have been shown are a modern material that can be used for medical and pedagogical control of the health of the students during of their university studies. Mean values of the morphological and functional parameters (in the form  $X \pm m$ ), indicating the standard deviation ( $\sigma$ ), minimum ( $X_{\min}$ ) and maximum values ( $X_{\max}$ ) are a part of the regulatory framework applicable in a comparative perspective to assess the level of a specific indicator of the student by the method of standards. Such assessment (individual or in cohorts of students) will serve as the basis for the correction state of the body or control over the use technology of save health (for physical education classes and/or the implementation of a variety of individual technologies recovery).

#### Conclusions.

1. There are no significant differences for separate body size (length and weight) in mean values indicators between of students (in groups young man and women) 3th and 4th courses of faculty of physical education (FPE) and other faculties with the exception of body mass in which the mean value of FPE female students more compared with the female students of other faculties ( $P < 0.05$ ) have been discovered.

2. Significant differences were found out on thickness of skin folds between students (in group of female) of FPE and other faculties. Students of FPE have thinner TSF over the triceps muscle and on abdomen ( $P < 0.001$ ) and under the angle of scapula and by sum of TSF ( $P < 0.01$ ).

In addition defined sexual features in the distribution of body fat and water in group of young man and women have been defined. Girls of FPE and other faculties have more the percent of body fat and lower body water compared with boys of similar faculties ( $P < 0.001$ ). However differences in the groups of young man and women in these indicators between the students which actively involved and not actively involved in physical training have not been found out.

3. The results are an important element of the regulatory framework for medical and pedagogical control of the health of modern students learning at the university, during their physical education and the use of different health technologies.

#### References:

- 1 Abyzova T.V., Sharova L.V., Sharov A.V. *Vestnik Iuzhno-Ural'skogo gosudarstvennogo universiteta* [Bulletin of the South Ural State University], 2010, vol.22(6, 182), pp. 127-131.
- 2 Andreyeva, A.V., Aristova I.S., Nikolenko V.N. *Matematicheskaja morfologija* [Mathematical morphology], 2007, vol.6(4), pp. 42-45.
- 3 Dragich O.A. *Zakonomernosti morfofunkcional'noj izmenchivosti organizma studentov iunosheskogo vozrasta v usloviakh Ural'skogo federal'nogo okruga* [Patterns of morphological and functional variability of the body of students teenagers during the Urals Federal District], Dokt. Diss., Tyumen, 2006, 52 p.
- 4 Izaak S.I. *Sostoianie fizicheskogo razvitiia i fizicheskoi podgotovlennosti mladogo pokoleniia Rossii i ikh korrekciia na osnove tekhnologii populacionnogo monitoringa* [State of physical development and physical fitness of young people in Russia and their correction technology based population monitoring], Dokt. Diss., Sankt Petersburg, 2006, 52 p.
- 5 Kuznecova M.V. *Osobennosti fizicheskogo razvitiia studencheskoj molodezhi Orenburzh'ia* [Features of the physical development of students of Orenburg], Cand. Diss., Orenburg, 2005, 22 p.
- 6 Levushkin S.P., Platonov R.I., Gulyayev M.D., Gotovtsev I.I. *Monitoring fizicheskogo sostoianiia shkol'nikov* [Monitor the physical condition of schoolchildren], Moscow, Soviet sport, 2012, 167 p.
- 7 Lyalikov S.A. Orekhov S.D. *Tablicy ocenki fizicheskogo razvitiia detej Belarusi* [Tables of assessing the physical growth of children in Belarus]. Grodno, GrGMU Publ., 2000, 63 p.
- 8 Negasheva M.A. *Morfologicheskaja konstituciia cheloveka v iunosheskom periode ontogeneza* [Morphological constitution of the person in the youth period of ontogenesis], Dokt. Diss., Moscow, 2008, 51 p.
- 9 Orlova S.V. *Ocenka sostoianiia zdorov'ia studentov iunosheskogo vozrasta s uchetom somatotipov* [Assessment of the state of health of students adolescence with the somatotype], Cand. Diss., Rostov-on-Don, 2004, 22 p.
- 10 Sokol'skaya T.I., Maksimenko V.B., Gulina A.V. *Pediatriia* [Pediatrics], 2009, vol.88(6), pp. 65–72.
- 11 Stoliarova N.V. *Teoriia i praktika fizicheskoi kul'tury* [Theory and practice of physical culture], 2011, vol.4, pp. 62–64.
- 12 Tegako L.I., Salivon I.I., Marfina O.V., Gurbo T.L. *Tablicy ocenki fizicheskogo razvitiia detej, podrostkov i molodezhi Respubliki Belarus'* [Tables of assessing the physical development of children, adolescents and young people of the Republic of Belarus], Minsk, Law and economics, 2008, 24 p.
- 13 Shmer V.V. *Teoriia i praktika fizicheskoi kul'tury* [Theory and practice of physical culture], 2012, vol.11, pp. 55–58.
- 14 Asienkiewicz R. *Physical activity of people at different age* [Aktywność ruchowa ludzi w roznym wieku], 2006, vol.7, pp. 230-235.
- 15 Kuchnio M., Forjasz J., Trzeciak J. *Physical activity of people of all ages* [Aktywność ruchowa ludzi w roznym wieku], 2008, vol.9, pp. 563-569.

- 16 Malinowski A. Tatarczuk J., Asienkiewicz R. *Anthropology for teachers* [Antropologia dla pedagogow], Zielona Gora, 2008, 225 p.
- 17 Tatarczuk J. *Biological and social conditions for the development of somatic and motor ability of selected groups of academic youth* [Biospołeczne uwarunkowania rozwoju somatycznego i sprawność motoryczna wybranych grup młodzieży akademickiej], Zielona Gora, 2006, 387 p.
- 18 Wojtyna J., Rodziewicz-Gruhn J. Self-assessment of the state of health and physical proficiency of female students, considering the biological condition and social and economic circumstances. *Medicina Sportiva*, 2007, vol.11(3), pp.84-87.
- 19 Wolanski N. *The biology development of human: the base of auxology, gerontology and health promotion* [Rozwoj biologiczny człowieka: podstawy auksologii, gerontologii i promocji zdrowia], Warsaw, AWF, 2005, 571 p.

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