Scientific Review of Physical Culture
e-ISSN 2658-0802

Comparative analysis of body structure and physical fitness among athletes and physical education students

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A - Study Design; **B** - Data collection;
C - Statistical analysis; **D** - Data interpretation;
E - Manuscript Preparation; **F** - Literature search;
G -Funds Collection

SRPC-ID:	SRPC14-2-2024	**Published online:**	1-09-2024	**ORIGINAL ARTICLE**

Abstract:

Introduction and purpose of the work: It is assumed that people who train demonstrate greater physical fitness. The aim of the study is to compare the body structure and physical fitness between athletes and students of physical education.
Material and method: The study was conducted among 27 women, including 15 female students and 12 female athletes. The following tests were used to assess physical fitness: CMJ and CMJ with swing, 60m run, Beep Test, trunk bend, 100% and 50% medicine ball throw. In order to determine body structure, anthropometric measurements of body mass, body height and circumferences of waist, hips, thigh, relaxed arm were taken.
Results: Athletes achieve better results in the CMJ and CMJ with swing, 60m run, Beep Test and 100% and 50% medicine ball throw. Students achieved better results in the flexibility test. Athletes are characterized by a higher level of oxygen max and greater body mass.
Conclusions: Athletes are characterized by a higher level of physical fitness in CMJ, CMJ with swing, 60 m run, Beep Test and kinesthetic sensation. Also VO2max in CWKS Resovia Rzeszów athletes was better. Only in the flexibility test students of the University of Rzeszów are characterized by significantly better results and it is the students who have a lower body mass.

Keywords: body structure, fitness, students, Beep Test

Introduction

Regular physical activity is essential for physical and mental health. It supports the proper development of children and maintaining physical fitness in adulthood. Regular exercise strengthens the cardiovascular system, improves circulation, lowers blood pressure, increases the level of good cholesterol and reduces the risk of heart disease, stroke and diabetes type 2. It also helps to maintain a healthy body weight and improves physical performance, increasing endurance, strength, flexibility and agility. Regular physical activity stimulates the release of endorphins, which improves mood, reduces stress and anxiety, it also increases self-esteem [1]. Therefore, it is important to encourage children from an early age to practice sports that interest them and bring them joy, which brings health benefits and prevents diseases. Athletics, as one of the available sports disciplines, develops comprehensive physical fitness and requires excellent technique. Progress in running, throwing and jumping techniques, supported by scientific research, allows for precise assessments and improvements. Achieving success in athletics requires regular training, proper nutrition and recovery. Physical fitness is essential in everyday life, influencing well-being, health and performance in everyday activities [2].

The aim of the study

The aim of the study is to compare the body build and physical fitness of Resovia Rzeszów athletes and students of physical education at the University of Rzeszów.

Material and methods

Characteristics of the research group.

The study involved women aged 18-22, training athletics at Resovia Rzeszów and students of physical education form the University of Rzeszów. It involved 27 people, including 12 female athletes and 15 female students. The study was conducted at the Resovia Rzeszów athletics stadium and at the University Athletics Center in Rzeszów. Each participant was informed about the upcoming tests. Athletes from the Resovia Rzeszów club train at the stadium 6 times a week. Among the 12 athletes were 4 sprinters, 4 middle-distance runners, 2 high jumpers and 2 specializing in the long jump. The female students of physical education from the University of Rzeszów train in sports clubs or actively spend time in the gym. Of them, 6 train in sports clubs: 2 play volleyball 3 times a week, 2 play football 5 times a week and 2 play handball 5 times a week.

Table 1. Average age of athletes and students.

	$\bar{x}$	sd
Athletes	20,73	1,10
Students	21,50	0,52
Athletes and students	21,16	0,90

Method

The tests were conducted at the Resovia Rzeszow athletics stadium and at the University Athletics Center in Rzeszow.

The following tests were performed to assess physical fitness:

1) CMJ without swing
   In the middle part of the dynamometric platform, the examined person stood on two legs, the person held their hands on the pelvis, then jumped upwards by bending the lower limbs at the knee joints. In the second test, the subject stood on both legs in the middle of the dynamometric platform, while jumping, swung their arms, moving them from a position along the body to a position stretched above the head. The measurement was recorded with an accuracy of 0.01 cm.
2) CMJ with swing
   The person stood on the middle part of the dynamometric platform on two legs, while jumping, swung their arms, by moving them from a position
   along the body to the position of stretching them above the head. The measurement was recorded to the nearest 0.01 cm.
3) Short run over a distance of 60 m
   The person started from the starting line from a high position. The measurement was taken with a stopwatch to the nearest 0.01 s. One attempt was made.
4) Beep-test
   The subject ran between two points, 20 meters apart, at a constantly increasing pace. The pace was given by an audible signal, during which the subject had to be outside the designated line with both legs. The result was recorded to the nearest 0.01 m.
5) Forward bending of the torso
   The subject performed a forward bending of the torso standing on a box. During the test, the legs were together, the knees straightened, and while performing the bend, the

subject had to reach with their hands as far as possible. The measurement was recorded to the nearest 0.01 cm.

6) Kinestatic sensation, overhead medicine ball throw
The subject had two attempts, he performed overhead throws. From behind the line examined person performed the first throw at 100%, then the researcher determined the distance the subject threw and informed that the second throw should be performed at 50% of his abilities. The throw distances were measured with a measuring tape. The read value was recorded to the nearest 0.01 m.

The following anthropometric measurements were performed:

1. Body mass
Body mass was measured without shoes. Participants stood on a personal scale in an upright position, with their arms freely lowered, with their legs slightly apart, and looked straight ahead. The reading was recorded to the nearest 0.01 kg.
2. Body height
Before measuring their height, the subjects took off their shoes. The measurement was taken using a height measuring device. Participants stood straight, with their arms freely lowered, with their legs slightly apart, looking straight ahead. The subjects stood with their backs to the height measuring device, so that their heels, buttocks, shoulders, and head touched the device. The distance from the base to the highest anatomical point on the head was measured to the nearest 0.1 cm.
3. Relaxed arm circumference
The participant stood in an upright position, with their right arm lowered along the torso. The measurement was taken by placing a tape measure halfway between two anthropometric points: the acromion and the radial. The result was recorded to the nearest 0.1 cm.
4. Waist circumference
During the measurement, the subject stood in an upright position. After a few free breaths, the measuring tape was placed between the top of the iliac crest and the rib border. The result was recorded to the nearest 0.1 cm.
5. Hip circumference
The hip circumference was measured with a measuring tape at the height of the largest posterior protuberance. The subject stood in an upright position with their feet together. The result was recorded to the nearest 0.1 cm.
6. Thigh circumference
The person stood in an upright position, with their feet slightly apart, with their body weight evenly distributed on both feet. The measurement was taken on the right leg using a measuring tape, measuring 1 cm below the buttock line. The result was recorded to the nearest 0.1 cm.
7. Sitting height
The examined person sat on a flat surface without a backrest, in an upright position, with his eyes directed forward. The sitting height was measured using a height gauge. The value was recorded to the nearest 0.1 cm.

Based on the obtained results, the following indicators were calculated:

WHR:
The WHR (waist to hip ratio) is calculated by dividing the waist circumference (in cm) by the hip circumference (in cm). The formula for WHR is as follows:

$$WHR = \frac{\text{waist circumference } (cm)}{\text{hip circumference } (cm)}$$

Interpretation of WHR values:
WHR > 0.8 indicates "apple-shaped" obesity
WHR < 0.8 indicates "pear-shaped" obesity

WHtR:
The WHtR (waist to body height ratio) is calculated by dividing the waist circumference (in cm) by the body height (in cm). The formula for WHtR is as follows:

$$WHtR = \frac{\text{waist circumference } (cm)}{\text{body height } (cm)}$$

Interpretation of WHtR values:
< 0.35: malnutrition
0.36 - 0.42: underweight
0.43 - 0.46: slightly underweight
0.47 - 0.49: normal body weight
0.50 - 0.54: overweight
0.55 - 0.58: severely overweight
0.59: obesity

BMI
Body mass index (BMI) is calculated by dividing body mass (in kg) by the square of body height (in m). The formula for BMI is as follows:

$$BMI\ indicator = \frac{body\ mass\ (kg)}{[body\ height\ (m)]^2}$$

In this study, basic statistical measures were used, such as: mean ($\bar{x}$), standard deviation (sd), coefficient of variation (V), minimum (min), maximum (max), probability (P) and the difference between means (d). The Mann-Whitney test was used to assess differences between the study groups.

Results

Table 2. Numerical characteristics of the body mass of the examined person [kg]

	$\bar{x}$	sd	v	min	max	d	p
athletes	62,37	4,84	7,76	55,10	70,20	1,92	0,000*
students	60,45	8,17	13,51	49,00	78,20		

**- statistical significance at the level of α⩽0.05*

Comparing the average body mass between the two groups studied, it can be seen that athletes have higher values of this parameter. The average body mass of athletes is 62.37 kg, while that of students is 60.45 kg. The difference between the averages was 1.92 kg, which is statistically significant. In the group of students, a greater internal differentiation was observed

Table 3. Numerical characteristics of the body height of the subjects [cm].

	$\bar{x}$	sd	v	min	max	d	p
athletes	170,00	4,80	2,82	163,40	178,10	2,41	0,000*
students	167,59	5,25	3,13	158,50	178,40		

**- statistical significance at the level of α⩽0.05*

Analyzing the average body height, it can be seen that athletes are taller than students by 2.41 cm. The average height of athletes is 170 cm, while the average height of students is 167.59 cm. The difference between the averages was 2.41 cm and is statistically significant. In the group of students, greater internal differentiation was noted.

Table 4. Numerical characteristics of the waist circumference of the subjects [cm].

	$\bar{x}$	sd	v	min	max	d	p
athletes	79,35	7,01	8,83	66,80	90,20	0,16	0,000*
students	79,19	7,46	9,42	69,10	91,50		

**- statistical significance at the level of α⩽0.05*

In the analysis of the average waist circumference, the athletes achieved a result of 79.35 cm, while the students achieved a value of 79.19 cm. The standard deviation differed by 0.45 cm between the groups. The coefficient of variation was 9.42% among the students, while among the athletes it was 5.9% lower. The minimum waist circumference in the group of athletes was 66.80 cm, while in the group of students it was 69.10 cm. The difference between the average values was 0.16 cm, which is statistically significant. In the group of students, a greater internal variability was noted.

Table 5. Numerical characteristics of the hip circumference of the examined persons [cm].

	$\bar{x}$	sd	v	min	max	d	p
athletes	100,30	5,66	5,64	91,30	108,10	1,93	0,000*
students	102,23	7,13	6,97	92,50	114,80		

*- statistical significance at the level of $\alpha \leqslant 0.05$

When analyzing the hip circumference, it can be seen that students have higher values of this parameter compared to athletes. The average hip circumference of students is 102.23 cm, while for athletes it is 100.30 cm. The difference between the means was 1.93 cm and is statistically significant. In the group of students, greater internal differentiation was observed.

Table 6. Numerical characteristics of the thigh circumference of the subjects [cm].

	$\bar{x}$	sd	v	min	max	d	p
athletes	62,66	6,58	10,50	51,20	71,60	0,17	0,000*
students	62,49	5,80	9,28	52,60	62,58		

*- statistical significance at the level of $\alpha \leqslant 0.05$

In the case of thigh circumference, the average value for athletes is 62.66 cm, while for students it is only 17 mm smaller. The coefficient of variation was 10.50% for athletes and 9.28% for students. The difference between the means was 0.17 cm and is statistically significant. In the group of athletes, greater internal variability was observed.

Table 7. Numerical characteristics of the relaxed arm circumference of the subjects [cm].

	$\bar{x}$	sd	v	min	max	d	p
athletes	30,96	3,64	11,75	25,30	37,10	0,64	0,000*
students	30,32	2,71	8,93	24,50	34,90		

*- statistical significance at the level of $\alpha \leqslant 0.05$

In the case of the average relaxed arm circumference, students achieve larger dimensions than athletes. The average value for students is 37.10 cm, while for athletes it is 30.96 cm. The difference between the averages was 6.14 cm and is statistically significant. In the group of athletes, a greater internal variability was observed

Table 8. WHR

	$\bar{x}$	sd	v	min	max	d	p
athletes	1,27	0,09	7,08	1,17	1,46	0,02	0,000*
students	1,29	0,10	7,75	1,09	1,53		

*- statistical significance at the level of $\alpha \leqslant 0.05$

When analyzing the WHR index, the average value for athletes was 1.27, while for students it was 1.29. The standard deviation was 0.09 for athletes and 0.10 for students. The coefficient of variation was 7.08% for athletes and 7.75% for students. The difference

between the means was 0.02 and is statistically significant. In the group of students, greater internal differentiation was noted.

Table 9. WHtR

	$\bar{x}$	sd	v	min	max	d	p
athletes	0,46	0,04	8,69	0,38	0,54	0,01	0,000*
students	0,47	0,04	8,51	0,40	0,55		

*- statistical significance at the level of $\alpha \leqslant 0.05$

When analyzing the fat tissue distribution index, the average value in athletes was 0.46, while in students it was 0.47. This indicates a slight underweight among athletes and a normal body weight among students. The standard deviation in both groups was identical and amounted to 0.04. The minimum and maximum values were similar in both research groups. The difference between the means was 0.01 and is statistically significant. In the group of athletes, greater internal variability was observed.

Table 10. CMJ [cm]

	$\bar{x}$	sd	v	min	max	d	p
athletes	44,68	6,53	14,61	35,97	55,38	8,26	0,000*
students	36,42	3,94	10,81	29,49	45,25		

*- statistical significance at the level of $\alpha \leqslant 0.05$

Comparing the average height of the vertical jump between the two groups, athletes achieve higher results. The average height of the vertical jump among athletes is 44.68 cm, while amomg the students it is 36.42 cm. The difference in the standard deviation between the groups is 2.69 cm, and the difference in the coefficient of variation is 3.80. The difference between the means was 8.26 cm and is statistically significant. In the athletes group, greater internal variability was noted.

Table 11. CMJ with a swing [cm]

	$\bar{x}$	sd	v	min	max	d	p
athletes	50,80	8,84	17,40	37,65	62,76	10,43	0,000*
students	40,36	3,05	7,55	35,88	45,92		

*- statistical significance at the level of $\alpha \leqslant 0.05$

Comparing the average height of the vertical jump with the swing, the athletes achieved an average result of 44.68 cm, while the students achieved an average of 40.36 cm. The difference in the standard deviation between the groups is 5.79 cm. The coefficient of variation differs significantly: in the athletes it is 17.40, while in the students it is 9.85, which is 7.55 less. The difference between the means was 10.43 cm and is statistically significant. In the group of athletes, a greater internal variability was noted.

Table 12. 60m run [cm]

	$\bar{x}$	sd	v	min	max	d	p
athletes	8,36	0,53	6,33	7,54	9,14	1,53	0,000*
students	9,89	0,79	8,00	8,84	11,56		

*- statistical significance at the level of $\alpha \leqslant 0.05$

In the 60 m race, the track and field athletes achieved better results, with an average time of 8.36 s, while the students needed over 1.5 s more. The standard deviation was 0.53 s for the track and field athletes and 0.79 s for the students, while the coefficient of variation was 6.33% and 8.00%, respectively. The differences are statistically significant. In the group of students, greater internal variability was observed.

Table 13. Beep Test - distance [m]

	$\bar{x}$	sd	v	min	max	d	p
athletes	1 680,55	551,09	32,79	740	2620	531,98	0,000*
students	1 148,57	385,56	33,57	700	1960		

*- statistical significance at the level of $\alpha \leqslant 0.05$

In the endurance test Beep Test, the athletes group achieved an average result of 1680.85 m, while the students achieved 1148 m. The standard deviation was 555.09 m for the track and field athletes and 385.56 m for the students. The coefficient of variation was similar: 32.79% for the track and field athletes and 33.57% for the students. The minimum distance covered by the athletes was 740 m, while for the students it was 700 m. The difference between the means was 531.99 m and is statistically significant. In the student group, a greater internal variability was observed.

Table 14. VO_2max [ml/kg/min]

	$\bar{x}$	sd	v	min	max	d	p
athletes	54,44	8,20	15,00	43,48	67,40	7,70	0,000*
students	46,74	5,54	12,00	40,49	58,43		

*- statistical significance at the level of $\alpha \leqslant 0.05$

Analyzing the VO2max test results, the athletes achieved a better level of VO2 max, with an average of 54.44 ml/kg/min, while the students had an average of 46.74 ml/kg/min. The difference is statistically significant. In the group of athletes, greater internal variability was noted.

Table 15. Forward bend of the torso (cm)

	$\bar{x}$	sd	v	min	max	d	p
athletes	6,63	3,05	45,99	2,30	11,50	5,91	0,0097*
students	12,53	7,27	58,00	0,00	23,00		

*- statistical significance at the level of $\alpha \leqslant 0.05$

In the measurement of a torso bend, it was noticed that female students achieved better results than male athletes. The mean among female students was 12.84 cm, while among male athletes it was significantly lower and amounted to 6.63 cm. The standard deviation was 3.05 cm in male athletes and 7.27 cm in female students. The coefficient of variation was 45.99% in male athletes and 58.00% in female students, respectively. The difference between the means was 5.91 cm and is statistically significant. In the group of female students, a greater internal variability was observed.

Table 16. Medicine Ball Throw [m]

	$\bar{x}$	sd	v	min	max	d	p
athletes	9,52	2,26	23,79	6,21	12,84	1,91	0,000*
students	7,61	1,62	21,31	5,25	10,53		

*- statistical significance at the level of $\alpha \leqslant 0.05$

In the medicine ball throw test, the average result of the athletes was 9.52 m, while the students achieved an average of 7.61 m. The difference in the standard deviation between the groups was 0.64 m. The coefficient of variation was 23.79% among athletes and 21.31% among the students. The difference between the means was 1.91 m and is statistically significant. Among athletes group, greater internal variability was noted.

Table 17. Medicine Ball Throw for 50% [m]

	$\bar{x}$	sd	v	min	max	d	p
athletes	5,10	1,17	22,95	3,55	7,56	0,92	0,000*
students	4,18	1,18	28,22	2,54	6,72		

*- statistical significance at the level of $\alpha \leqslant 0.05$

In the medicine ball throw test at 50% of their ability, the athletes achieved an average result of 5.10 m, while the students achieved 4.18 m. In relation to the throw at 100% of their ability, the result at 50% was on average 53.57% among the athletes and 54.92% among the students, which suggests a similar level of kinesthetic sensation in both groups. The results are statistically significant. Greater internal variability was observed in the group of students.

Discussion

A comparative analysis of physical fitness and body composition of athletes and physical education students plays a key role in understanding the differences between these groups in terms of physical abilities and morphological features. Scientific research provides valuable data on these differences, which allows for a better understanding of the impact of specialist athletic training on physical fitness and body composition. Assessment of physical fitness is an important element in monitoring a person's physical development and assessing the effectiveness of programs aimed at improving it. Various tests are used to assess various aspects of physical fitness, which allow for determining the current level of fitness of the subject [3].

The first study conducted was the assessment of lower limb muscle strength, especially in the CMJ test. In our own research, it was found that the largest number of athletes achieved an average result of 44.68 cm, while students achieved an average of 36.42 cm. In the study by Klimczyk and Słoma comparing students from the sports and general classes at Primary School No. 18 in Toruń, the average vertical jump was 40 cm for the sports class and 28 cm for the general class, which meant a difference in average results of 12 cm between these groups of students [4].

The next examined test was a speed run over a distance of 60 meters. Participants started from a high position in front of the starting line. In our own study, the average time among athletes was 8.36 s, while students achieved an average of 9.89 s, which indicates a significantly better speed in athletes group. In her work, Romańska conducted research at the Primary School in Gostyn among 12-year-old girls and boys. In 2007, the minimum time was 9.3 s, and in 2019 9.5 s. The longest time was 14.5 s in 2007 and 14.6 s in 2019, respectively. The average running time decreased significantly from 11.3 s in 2007 to 12.0 s in 2019 [5].

Similar results were observed in other studies. Johnson et al. found that the average times of 60-meter sprinters were below 8 seconds, while the control group,

which also included physical education students, achieved average times exceeding 9 seconds [6].

Another study by Gonzalez-Badillo et al. compared the results of sprinters and physical education students over a distance of 100 meters. The results showed that the athletes achieved significantly better times than the students, which can be attributed to better running technique and greater muscle strength [7].

Analyzing the results of the 60 m race of students from the sports class and the general class at Primary School No. 18 in Toruń, it was again found that the students from the sports class achieved better results. The average running time in the sports class was 9.17 s, while in the general class it was 10.62 s. Comparing these results with the groups of athletes and physical education students, it can be seen that the differences in average times are similar: the difference between the athletes and the students was 1.53 s, and between the students from the sports class and the general class 1.45 s [4].

Syska and Kuptel, based on their own research, determined that students from the sports group were characterized by a better level of physical fitness. In September, they ran a distance of
60 m in an average time of 9.58 s, and in April of the following year, the students achieved an average result of 9.36 s [8].

The next test was the Beep Test, used to assess endurance. The athletes achieved better results in terms of both endurance and the level of oxygen max. The average distance run by the athletes was 1680.55 m, while the students achieved an average of 1148.57 m. The VO2max of the athletes was 54.44 ml/kg/min, while for the students it was 46.74 ml/kg/min.

A similar study by Sperlich et al. aimed to compare the endurance of athletes specializing in long-distance running with the results of physical education students, using the Beep Test as a measuring tool. The results of this study showed significant differences in endurance between athletes and students. The athletes ran significantly longer distances during the Beep Test compared to students. The study suggests that intensive aerobic training, typical for long-distance athletes, contributes to improved physical performance. Athletes devote a lot of time for training that develops their aerobic endurance and running technique, which translates into increased oxygen capacity and energy efficiency, which ultimately leads to better results in endurance tests [9].

In our own research, it was observed that students achieved significantly better results in terms of flexibility. The difference between the groups was clear: the average result of students was 12.53 cm, while the athletes achieved an average of 6.63 cm. In her work on physical fitness, Kochanowicz conducted a forward bending test among female students of physiotherapy at the Medical Academy in Gdańsk, where the average result was 14.1 cm [10].

In her research, Makris showed that in flexibility measured by forward bending of a torso, the best result was achieved by students from the Institute of Physical Culture of the University of Szczecin – 11.71 cm, ahead of students from the Pomeranian Medical Academy by 3.9 cm and students from the Szczecin University of Technology by 3.04 cm. Only the differences between the arithmetic means of students from the Institute of Physical Culture of the University of Szczecin and representatives of other universities are statistically significant. Analyzing the coefficient of variation, the highest level of diversification of results was found among students from the Pomeranian Medical Academy, and the lowest

among students from the Institute of Physical Culture of the University of Szczecin [11].

The last test concerned the assessment of strength and kinesthetic sensation. In our own research, it was observed that athletes threw an average of 5.10 m, while students achieved an average of 4.18 m. When comparing a throw at 100% with a throw that was supposed to be performed at 50%, athletes achieved an average of 53.57%, and students 54.92%, which indicates similar kinesthetic sensation in both groups. These results are statistically significant.

In their work, Hojda and Wasiak noted a significant improvement in strength abilities. In the 3 kg medicine ball overhead throw test, measuring the strength of the upper limbs and trunk, handball players achieved an average result of 11.90 m in the first measurement, and a month later this result improved to 12.47 m, which means an increase of 57 cm. These results were also statistically significant, which suggests the effectiveness of the training methods used [12].

Makris conducted research on students of various universities in Szczecin, measuring strength by throwing a medicine ball. Students of the Institute of Physical Culture of the University of Szczecin achieved the best result, which was 9.83 m. Students of the Pomeranian Medical University achieved an average of 1.69 m less, and students of the Szczecin University of Technology achieved 1.84 m less. The differences between the results of students of the Institute of Physical Culture and the other universities were statistically significant. The analysis showed the highest diversification of results among students of the Szczecin University of Technology, and the lowest among students of the Institute of Physical Culture. Students of Szczecin universities had higher height and weight parameters compared to their peers from other cities, which could have influenced their results [11]. There is a strong correlation between body build and sports success, especially in short-term efforts of a speed-strength nature. Wesołowska conducted research on a group of 13-14-year-old girls from junior high schools in Szczecin, who were divided into three subgroups according to their hurdle times. She measured their body mass and height, and the results were from 147.7 to 151.6 cm in height and 40 to 44 kg in weight. In comparison with their peers from other Polish cities, who had an average height of 155.2 to 157.7 cm and a weight of 44.8 to 47.7 kg, the students from Szczecin were taller (162.39 cm) and heavier (51.08 kg).

The results showed that in the group of untrained children and adolescents, it is not the somatic structure but the level of motor skills that determines sports results [13]. Referring to our own research, the results showed that athletes are taller than students, reaching an average height of 170.00 cm compared to 167.58 cm in students. In addition, the athletes had a greater body mass, on average 62.37 kg, while the students had 60.45 kg. Analyzing our own research, it is noted that the athletes from CWKS Resovia Rzeszów demonstrated better physical fitness in the physical fitness tests. In the tests of lower limb strength, speed, endurance, and strength and kinesthetic sensation, the athletes achieved better results than the students of the University of Rzeszów. The athletes also demonstrated a higher level of oxygen max. On the other hand, in the flexibility test, which involves bending the trunk forward, the students had significantly better results. The advantage of the athletes in the fitness tests results from the large amount of time devoted to training, which is versatile and translates into better results [14].

Conclusions

1. Students achieve higher results only in the flexibility test, while in the CMJ, CMJ with swing, 60 m run, Beep Test and medicine ball throw (100% and 50% power) better results are achieved by athletes.
2. Physical education students have worse results in the 60 m run.
3. Physical education students show lower endurance compared to track and field athletes.
4. Students have a lower body mass.

The conducted research allowed for the implementation of the assumed goal and analysis of individual parameters. Athletes achieved better results in the CMJ, CMJ with swing, 60 m run, Beep Test and medicine ball throw (100% and 50% power). Only in the flexibility test did students show better efficiency. CWKS Resovia Rzeszów athletes are also characterized by a higher level of VO2max. Students have a lower body mass.

References

1. Wallhead, T. L., Buckworth, J. (2004). The role of physical education in the promotion of youth physical activity. Quest, 56(3), 285-301.
2. Vanhees, L., Lefevre, J., Philippaerts, R., Martens, M., Huygens, W., Troosters, T., Beunen, G. (2005). How to assess physical activity? How to assess physical fitness? European Journal of Preventive Cardiology, 12(2), 102-114.
3. Soukup Sr, G. J., Henrich, T. W., Barton-Weston, H. M. (2010). Differences in Exercise Identity between Secondary Physical Education Students and Athletes. ICHPER-SD Journal Of Research, 5(1), 33-36.
4. Klimczyk, M., Słoma, P. (2014). Comparative analysis of the level of development of motor skills in sports and general classes at Primary School No. 18 in Toruń. Journal of Health Sciences, 4(1), 391-400.
5. Romańska M. Physical fitness of selected students of Primary School No. 3 named after the Defenders of Westerplatte in Gostynin. (Access: 07.05.2023).
6. Johnson, T., Miller, R., Smith, J. (2017). Comparative Analysis of Sprint Performance and Body Composition in Track and Field Sprinters and Recreationally Active Men. Journal of Exercise Science & Fitness, 15(1), 19-24.
7. González-Badillo, J. J., Yanci, J., Gorostiaga, E., Marques, M. C. (2014). Sprinting Intensity Influences Muscle Fiber Recruitment Patterns and Implications for Training. Journal of Strength and Conditioning Research, 28(11), 3024-3032.
8. Syska, J. R., Kuptel, R. (2009). Physical fitness of students practicing and not practicing handball. Monograph no. 12, 12, 27-36.
9. Petkov, P., Shoshev, M. (2017). Study of female students' resilience. Trakia Journal of Sciences, 15(1), 442-445.
10. Kochanowicz, B. (2007). The level of physical fitness of students of physiotherapy at the Medical University of Gdańsk and their opinion on different forms of physical activity. Annales Academiae Medicae Gedanensis, 37, 53-62.
11. Makris, M. (2007). Physical development and motor fitness of first-year students of Szczecin universities. Scientific Papers. Works of the Institute of Physical Culture. University of Szczecin (24) 37-39.
12. Hojda, S., Wasiak, R. 14. Changes in the level of general physical fitness during the preparatory period of the 2007/2008 season of the senior handball team of KS "Vive" Kielce. Monograph no. 12, 12, 109.
13. Wesolowska, J. (2008). The influence of the somatic structure of 13-14-year-old schoolgirls on the results in hurdling with different rules. Scientific Papers. Works of the Institute of Physical Culture. University of Szczecin, 25(570), 69-78.
14. Krakowiak, H., Cabrić, M., Sokołowska, E., Lewandowski, A. (2008). Body composition of athletes training in short runs. PolishJournal of Sports Medicine/Medycyna Sportowa, 24(1).