



SOMATICS AND PHYSICAL FITNESS OF SELECTED MILITARY CLASSES

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Abstract The idea of opening military classes refers to the tradition of national defense education, training the young generation to defend the homeland and strengthening the country's ties with the army. The creation of military classes became a precedent for the Ministry of National Defense and the Ministry of National Education to build a common defense education system for high school students. The task of military classes in Polish high schools is to prepare young people for future service in various services, such as police, fire brigades and other special services. The aim of this work is to capture the relationship between body composition components and physical fitness of selected uniformed groups. The body composition components were analyzed with the help of the Tanita Body Composition Analyzer DC-240MA. The study used tests from the Polish Army physical fitness test, the Beep test and barbell bench press while lying on a straight bench. One of the conclusions obtained was that the

correlation between body composition and fitness tests showed that higher levels of body fat, lean body mass, BMI and body weight negatively affect the results obtained in pull-ups, trunk bends, shuttle runs and Beep tests.

Key words: military classes, body composition, physical fitness, beep test

Introduction

The idea of opening military classes refers to the tradition of national defense education, training the young generation to defend the homeland and strengthening the country's ties with the army (Odziemkowski, 1996). The creation of military classes became a precedent for the Ministry of National Defense and the Ministry of National Education to build a common defense education system for high school students (Kaliński, 2000). The task of military classes in Polish high schools is to prepare young people for future service in various uniformed services, such as police, fire brigades and other special services. They are aimed at developing the skills, values and competencies necessary to work in these professions and at shaping patriotic and civic attitudes. The current popularity of military classes in combination with objective, standardized recruitment criteria and attractive programs are conducive to the implementation of ambitious didactic and educational goals. Achieving these goals depends to a large extent on the cooperation of schools and military classes with military units and other organizational units of the ministry or on the support of the local community. It also depends on the commitment and knowledge of teachers conducting military classes and the values that characterize students in these classes (Kanarski et al., 2016). The concept of human physical fitness is interpreted and defined differently depending on the person. Unification of this phenomenon is impossible, therefore definitions on this subject from different authors should be adopted here. The basic motive for examining fitness as a whole of human behavior, abilities and motor needs is the desire to increase the efficiency of human movement, to improve the teaching of movement and its use as a means of stimulating development (Grabowski, 1997). Physical fitness is an ambiguous concept. According to Przewęda (1985), it is possible to interpret it as an ambiguous concept by assigning at least four interpretative approaches: motor, mechanistic-biological, behavioral-cultural and health. The best known and popular in Poland, especially in the theory of physical education, is the method of defining fitness, proposed in the behavioral and cultural convention. This shows that the authors consider a fit person as a person "who has a specific potential of capabilities (is able to), skills (can) and motivation (want), allowing him/her to function properly in specific environmental conditions" (Przewęda, 1985). Clarke claims that physical fitness is: "the ability to conduct all-day activities with vigor and briskness, without excessive fatigue and with a lot of energy needed to spend time pleasantly in various and often unpredictable situations" (Clarke & Clarke, 1978). Physical fitness has been recognized as a key determinant of a healthy lifestyle, increasingly based on criteria related to general health, not just mobility. It has a positive effect on the circulatory and respiratory system, combats general and abdominal obesity, helps strengthen bones and prevents depression and anxiety (Ortega, 2007). The recommendations of the World Health Organization (WHO) are that children and adolescents should perform at least 60 minutes of moderate or high-intensity physical activity every day to maintain good health and maintain a healthy weight (Hallal, 2012). For Howley and Frank the goal of physical fitness is preventing the risk of diseases. "The goal of physical fitness is positive physical health, which determines a low risk of health problems. Achievements are aimed at the ability to engage in daily tasks with adequate energy and satisfactory participation in selected sports" (Howley & Frank, 1997). Physical fitness as the ability to effectively

cooperate with the physiological functions of the body, allows you to perform everyday activities using little effort, and at the same time is a requirement to maintaining health. An able-bodied person is able to work at school, do housework and still has enough energy to practice sports and other forms of spending free time (Haible et al., 2020; Shen et al., 2021). At the same time, undertaking moderate or intense physical activity increases physical fitness and may contribute to reducing sedentary behavior and improving positive health indicators (Knudson & Brusseau, 2022; Mancha-Triguero et al., 2019; Ljach, 2003; Fugiel et al., 2017). It is also understood as the general ability to safely perform everyday activities (Rydzik & Ambroży, 2021). Its level depends on complex genetic factors and physical activity. It includes a number of specific components that kinesiology experts are interested in (Knudson & Brusseau, 2022). A high level of physical fitness is a key element of effectiveness in sports competitions. Knowing the level of their competitors, coaches can choose appropriate training loads, i.e. types of exercises, their quantity and quality. In addition, regular fitness level measurements can help evaluate training effects (Mancha-Triguero et al., 2019). General physical fitness determines the motor skills of the human body. Motor skills are individual psychophysical properties that determine the level of motor abilities (Ljach, 2003). They are a group of predispositions conditioned genetically and shaped by environmental conditions (Fugiel, 2017). Motor skills are most often defined on the basis of strength, speed, endurance, agility and power (Bielski, 2012). They are often related to each other and to other determinants of performance in a given sport (Bora, 2020). When reviewing the literature related to fitness testing, you will come across a wide variety of research studies. In one such study, soldiers from the Croatian Navy were tested. The aim of the study was to determine the influence of body weight on fitness tests of personnel. The research group consisted of 42 members of the navy. To assess the fitness of soldiers, a test procedure was used, which included 7 fitness tests and 15 anthropometric body measurements. A negative correlation was found between body fat percentage and all analyzed sprint trials and three anaerobic power tests. Body fat content was also not significant in performance tests on $\dot{V}O_{2max}$. A positive correlation was found between the sprint test and the measurement of thigh and calf circumference. Ectomorphic somatotypes have positive correlations with all variables. Mesomorphic somatotypes have the greatest positive correlations with all variables. Endomorphic somatotypes have negative correlations with all variables. Based on the body composition of Croatian navy soldiers, it can be concluded that they need a sufficient level of strength and endurance to perform daily tasks (Kosmalski et al., 2014). Kosmalski et al. conducted a study aimed at evaluating the somatic features and motor skills of 6th class students of primary school in Szubin. The research group consisted of 25 boys and the same number of girls. Fitness level was assessed by ICSPFT, and body weight and height were measured to calculate BMI. As a result of the research, it was shown that children from primary school no. 2 in Szubin are characterized by a higher body weight and shorter height than the average from national surveys. The research group is also characterized by a higher level of strength and lower endurance than the national average (Pletcher et al., 2023). The author of the research conducted on the marines investigated the impact of body composition on the results of a combat fitness test. The research group consisted of 210 men and 84 women aged 20 to 26. The Marine Corps designed the Combat Proficiency Test (CFT) to emphasize functional fitness related to operational requirements. The purpose of this study was to investigate the relationship between body mass (BM), lean mass (FFM) and body fat percentage (BF%) as measured by air displacement plethysmography. The Kruskal-Wallis test or one-way analysis of variance was used to determine whether there were significant differences in total scores and CFT components between the study groups divided into the BM, FFM, and BF% quintiles. There were no significant differences in CFT scores between male and female BM quintiles and no significant differences in CFT scores between male FFM quintiles.

However the CFT total score was significantly different between BF% quintiles in men and significantly different in women. Marines in the quintile with the lowest BF percentage had better CFT scores than those in the higher quintiles (Mendoza-Muñoz et al., 2020). The study of another author was aimed at examining the relationship between body composition and physical fitness of adolescents and analyzing whether there are differences in physical condition and body composition between the sexes. A group of 225 teenagers was examined, including 108 boys and 117 girls. Body weight status was classified according to WHO 2007 standards and included variables such as BMI, body fat mass, body fat percentage and body fat free mass. As part of the physical fitness test, a standing long jump was performed, as well as a test for speed, agility, circulatory and respiratory capacity, and grip strength. There were significant gender differences in body composition (FM%, FM and FFM) and physical fitness in favor of men. Significant differences were also found in speed and standing long jump in favor of adolescents with normal body weight compared to adolescents with overweight and obesity. The results showed that cardiorespiratory fitness and standing long jump correlated inversely with BMI, FM% and total FM. There was also a direct relationship between speed and agility and body fat mass, as well as between grip strength and lean body mass (Sterkowicz-Przybycień, 2019). Farina. et al. conducted research during special forces training of US Army soldiers. The aim of the study was to determine whether anthropometry and body composition affected physical fitness and selection for special forces training. Body height, weight and BMI were measured as well as body composition measured by dual energy X-ray absorptiometry (fat percentage, fat mass, fat free mass, bone mineral density [BMC] and bone mineral density [BMD]). Lower body fat percentage and fat mass predicted better results across all assessments: military fitness test (APFT), pull-up bar, SFAS run, weighted road walking, obstacle course and land navigation. Higher fat-free mass predicted better weighted road walking performance. Lower body weight and BMI predicted better APFT, pull-up, running, and obstacle course. Higher body weight and BMI predicted better weighted street walking. Effects were the best for lean body mass and body fat percentage. Anthropometry and body composition have been shown to influence performance and the success of SFAS (Farina et al., 2022).

Aim of the paper

The aim of this work is to capture the relationship between body composition components and physical fitness of selected military classes. Based on the purpose of the work, research questions were formulated. What are the differences in body composition between the two military classes? Do body composition components affect the results achieved during fitness tests? How do the results of physical fitness differentiate diagnosed military classes?

Material and methods

This study was carried out on a group of 23 men from uniformed classes from the Secondary School in Leżajsk. The subjects were 11 students from the first class and 12 students from the fourth class. In the military class, each student fulfills (weekly) four hours of physical education and two hours of specialized classes for military classes. Due to the specificity of their profile at school, the students included in the study do not have any contraindications to practicing sports and are fully healthy. Before starting the research, each respondent was informed about its purposefulness and that the research was fully anonymous. The tests were performed with prior parental consent.

The average body weight of the respondents from the first class was 68.7 kg. The minimum weight is 54 kg and the maximum weight is 80.4 kg. The value of the population standard deviation was 9.33. The body height

of the subjects oscillated between 172 cm and 184 cm, with the average being 177.5 cm and the deviation from the average being 3.50.

The average body weight of the subjects in the fourth class was 82.5 kg. The minimum value for men in the fourth class is 68.8 kg and the maximum is 101 kg. The deviation from the norm was 9.14. The body height of the respondents oscillated between 173 cm and 193 cm. Their arithmetic mean was 183.1 cm and the deviation from the mean was 6.03.

Research method

The research took place at the Secondary School in Leżajsk from 12 to 16 September 2022. Body composition components and fitness tests of the surveyed students were carried out during physical education classes in the school gym, on the pitch and in the sports hall. During the tests, the students were dressed in sports outfits and fitness tests took place after a 10-minute general warm-up.

Measurements of body height and body composition were taken without shoes and without socks in order to thoroughly examine all components. The body composition components were analyzed with the help of the Tanita Body Composition Analyzer DC-240MA and the evaluation is given:

- total body weight,
- body mass index (BMI – Body Mass Index),
- percentage of body fat (Fat %),
- body fat mass (FM – Fat Mass),
- lean body mass (FFM – Fat Free Mass),
- muscle mass in the body (MM – Muscle Mass).

The study used tests from the Polish Army physical fitness test, the beep test and barbell bench press while lying on a straight bench.

The study included the following trials:

- High bar pull-ups

The bar was attached to ladders in the gym at a height of 220 cm. At the “ready” command, the trainees took the starting position of the exercise in a hanging overhand grip with straightened elbow joints. At the signal of the examiner, the trainee began to perform pull-ups. A correct pull-up was counted when the chin line was crossed over the bar and the elbow joint was fully straightened. During pull-ups, the strength of the back muscles, upper limbs and their endurance are assessed.

- Trunk bends in 2 minutes

The exercise is performed lying on the back on the mat with the feet attached to the lower rung of the ladders. The legs are bent at the knees and the intertwined arms are placed behind the head. On command, the trainee starts to perform the exercise. An exercise performed correctly is when the exerciser does not take his hips off the mat, the elbows touch the knee and when returning to the starting position the exerciser touches the ground with the shoulder blades. Do as many repetitions as possible in 2 minutes. During the bends, the strength and endurance of the abdominal muscles are assessed.

- Shuttle run

The shuttle run is performed over a distance of 10 by 10 meters. At the signal, the trainee starts running towards the cone, runs around it and returns to the starting cone, which he also runs around, thus starting the

second lap. Such a route is performed five times on time and after each lap the evaluator informs about the number of repetitions. In the shuttle run, the speed and agility of the exerciser are assessed.

- Beep test

The beep test is an endurance test that involves running between two markers 20 meters apart. The pace is given by a sound signal and the exerciser's task is to run the section within the given time. If the exerciser reaches the marker before the signal, he waits for it before moving on. With each level reached, the signal accelerates and the practitioner must fit within the designated time interval. In the case of not fitting between the signals twice, the trainee drops out of the test.

- Barbell press lying on a straight bench

The exercise consists in squeezing as much load as possible while lying on a straight bench. Before performing the final test, the trainee performs several preliminary series in order to prepare the muscles for the maximum load. The exercise is performed with the arms apart at the width of the shoulder girdle and the lower limbs are to be in constant contact with the ground. The attempt is passed when the exerciser touches the barbell to the chest and presses the weight above himself to almost maximum extension in the elbow joint. The test is performed in the belaying of two people. In the barbell press, the strength of the shoulder and chest muscles is assessed.

Results

Table 1. Characteristics of the first military class body composition components

Somatic features and components of body composition	Class I			
	Mean	Minimum	Maximum	Standard deviation
body height (cm)	177.5	172	184	3.50
body weight (kg)	68.7	54	80.4	9.33
fat (%)	12.4	4.2	22.6	5.91
fat mass (kg)	9.0	2.4	18.2	5.22
fat free mass (FFM) (kg)	59.6	51.2	65.4	4.82
muscle mass (kg)	56.8	48.4	62.6	4.82
body mass index (BMI)	21.7	18.3	26.6	2.61

The conducted analysis of the components of the body composition of the first military class showed the level of body fat. The average Fat % value was 12.4%, the minimum value was 4.2% and the maximum was 22.6%. The deviation of body fat from the mean was 9.33. In the study group, the weight of fat ranged from 2.4 kg to 18.2 kg and the average value was 9 kg. Military-class lean body mass averaged 59.6 kg, with a minimum of 51.2 kg and a maximum of 65.4 kg. The population standard deviation in FFM was 4.82. The average muscle mass index was 56.8 kg, its minimum value was 48.4 kg and its maximum value was 62.6 kg. On the basis of body weight and height, BMI was calculated, the average value of which was 21.7, the minimum value was 18.3, the maximum value was 26.6, and the deviation from the average BMI was 2.61.

Table 2. Characteristics of the components of the body composition of the IV military class

Class IV				
Somatic features and components of body composition	Mean	Minimum	Maximum	Standard deviation
body height (cm)	183.1	173	193	6.03
body weight (kg)	82.5	68.8	101	9.14
fat (%)	16.9	8.2	24.7	4.44
fat mass (kg)	14.3	5.6	24.9	5.17
fat free mass FFM (kg)	68.2	61.3	76.1	4.55
muscle mass (kg)	65.4	58.5	73.3	4.55
body mass index BMI	24.6	21.5	27.2	1.84

Among the students of the fourth military class, the average level of body fat was 16.9%, its minimum value was 8.2% and the maximum was 24.7%. The deviation from the mean body fat value was 4.44. In the study group, the mass of fat oscillated from 5.6 kg to 24.9 kg, and its average value was 14.3 kg. The average lean body mass of the respondents was 68.2 kg, minimum 61.3 kg and maximum 76.1 kg. The deviation of this value from the mean was 4.55. The muscle mass of the study group ranged from 58.5 kg to 73.3 kg and its average value reached 65.4 kg. On the basis of body weight and height, BMI was calculated, the average value of which was 24.6, the minimum value was 21.5, the maximum value was 27.2, and the deviation from the average BMI was 1.84.

Table 3. Table of points for the shuttle run from the physical fitness test of professional soldiers (Journal of Laws of the Republic of Poland, Warsaw, December 22, 2020, item 2331, Regulation of the Minister of National Defense)

Time	Points	Time	Points
28.6	19.0	31.2	10.2
28.7	19.0	31.3	9.8
28.8	19.0	31.4	9.4
28.9	19.0	31.5	9.0
29.0	19.0	31.6	8.6
29.1	18.6	31.7	8.2
29.2	18.2	31.8	7.8
29.3	17.8	31.9	7.4
29.4	17.4	32.0	7.0
29.5	17.0	32.1	6.6
29.6	16.6	32.2	6.2
29.7	16.2	32.3	5.8
29.8	15.8	32.4	5.4
29.9	15.4	32.5	5.0
30.0	15.0	32.6	4.6
30.1	14.6	32.7	4.2
30.2	14.2	32.8	3.8
30.3	13.8	32.9	3.4
30.4	13.4	33.0	3.0
30.5	13.0	33.1	2.6
30.6	12.6	33.2	2.2
30.7	12.2	33.3	1.8
30.8	11.8	33.4	1.4
30.9	11.4	33.5	1.0
31.0	11.0	33.6	0.6
31.1	10.6	33.7	0.2

Table 4. Table of pull-ups from the physical fitness test of professional soldiers (Journal of Laws of the Republic of Poland, Warsaw, December 22, 2020, item 2331, Regulation of the Minister of National Defense)

Repeat	Points
18	21.0
17	21.0
16	21.0
15	21.0
14	20.2
13	19.4
12	18.6
11	17.8
10	17.0
9	16.2
8	15.4
7	14.6
6	13.8
5	13.0
4	12.2
3	11.4
2	10.6
1	9.8

Table 5. Table of torso tilts from the physical fitness test of professional soldiers (Journal of Laws of the Republic of Poland, Warsaw, December 22, 2020, item 2331, Regulation of the Minister of National Defense)

Repeat	Points	Repeat	Points
70	16.0	49	11.8
69	15.8	48	11.6
68	15.6	47	11.4
67	15.4	46	11.2
66	15.2	45	11.0
65	15.0	44	10.8
64	14.8	43	10.6
63	14.6	42	10.4
62	14.4	41	10.2
61	14.2	40	10.0
60	14.0	39	9.8
59	13.8	38	9.6
58	13.6	37	9.4
57	13.4	36	9.2
56	13.2	35	9.0
55	13.0	34	8.8
54	12.8	33	8.6
53	12.6	32	8.4
52	12.4	31	8.2
51	12.2	30	8.0
50	12.0		

Table 6. Classification of the first class students' points from the physical fitness test of professional soldiers

	Mean	Minimum	Maximum	Standard deviation
pull-ups	15.0	9.8	21.0	3.62
torso bends	13.5	11.4	15.4	1.19
shuttle run	12.6	2.6	19.0	5.70

Based on the scores from the physical fitness test of professional soldiers, it was possible to determine the number of points from fitness tests obtained in the first military class. The average number of points scored in the pull-up test was 15, the minimum was 9.8 and the maximum was 21. The deviation from the average was 3.62. In the timed trunk bending test, the average number of points obtained by the subjects reached the value of 13.5, the minimum 11.4, the maximum 15.4, and the population standard deviation was 1.19. Respondents in the shuttle run received from 2.6 to 19 points and the average was 12.6 points. The deviation from the mean in this sample was 5.70.

Table 7. Classification of the fourth class students' points from the physical fitness test of professional soldiers

	Mean	Minimum	Maximum	Standard deviation
pull-ups	13.9	11.4	21.0	3.20
torso bends	13.4	10.8	15.4	1.36
shuttle run	9.9	0.0	19.0	6.93

The respondents in the pull-up test scored from 11.4 to 21 points, with an average of 13.9 points. Deviation from the average in pull-ups is 3.20. The average number of points obtained in trunk slopes reached 13.4, the minimum 10.8, the maximum 15.4 and the population standard deviation 1.36. The test group in the shuttle run received an average of 9.9 points. Their minimum value was 0 and the maximum was 19. The deviation from the mean in this sample was 6.93.

Table 8. The first military class students' fitness test results

Test type	Mean	Minimum	Maximum	Standard deviation
pulling up on the bar	7.5	1.0	16.0	4.68
beep test	1040.0	500.0	1500.0	326.19
torso bends	57.7	47.0	67.0	5.97
shuttle run	30.5	28.1	33.1	1.54
barbell press	75.3	62.0	88.0	7.90

The average number of pull-ups on the high bar in the first military class was 7.5, the weakest attempt was 1 repetition and the best 16. The deviation from the average was 4.68. The tested group in the beep test achieved results from 500 meters to 1500 meters. The average value in the fitness test was 1040 meters and the standard deviation of the group was 326.19. In the forward bend test, the respondents achieved an average score of 57.7 repetitions. The minimum value of this test is 47 slopes, while the maximum is 67. A group of military first-class students in the shuttle run achieved results from 28.1 to 33.1 seconds. The average value of the group in this run was 30.5 seconds, while the standard deviation from the mean was 1.54. During the barbell press on a straight

bench, the subjects achieved results from 62 kg to 88 kg. The average bench press value in the first class was 75.3 kg and the deviation from the mean was 7.90.

Table 9. The fourth military class students' fitness tests results

Test type	Mean	Minimum	Maximum	Standard deviation
pulling up on the bar	6.2	3.0	15.0	4.00
beep test	1015.0	520.0	1540.0	304.32
torso bends	57.1	44.0	67.0	6.84
shuttle run	31.3	28.0	34.4	1.95
barbell press	93.3	78.0	120.0	12.30

In the test for the maximum number of pull-ups on the high bar, the average value of the subjects was 6.2 repetitions, the smallest 3 and the largest 15. The deviation from the average was 4. During the beep test, the results oscillated from 520m to 1540m. The average value of the uniformed group in this test was 1015m and the deviation was 304.32. The forward bends ranged from 44 to 67 repetitions and their average value was 57.1. The shuttle run in the fourth military class averaged 31.3 seconds, the fastest time was 28 seconds and the worst time was 34.4 seconds. During the barbell press on a straight bench, the subjects achieved results from 78 kg to 120 kg. The average bench press value was 93.3 kg and the deviation from the average was 12.30.

In order to find out whether body composition affects the results obtained from fitness tests, Pearson correlations were performed with all data.

Table 10. The value of the correlation coefficient and interpretation

Correlation coefficient value	The strength of the relationship
below 0.2	poor (no relationship)
0.2-0.4	short
0.4-0.6	moderate
0.6-0.8	high
0.8-0.9	very high
0.9-1.0	full dependency

Table 11. The influence of body weight on the results obtained in fitness tests

	Pull-ups	beep test	Torso bends	Shuttle run	Barbell press
class I	-0.57	-0.75	-0.80	0.65	0.93
class IV	-0.60	-0.37	-0.84	0.87	0.86

The results of the Pearson correlation show that the greater the weight of the subject's body, the worse the result in the high bar pull-up test. The correlation in this case obtained a moderate value in both military classes. During the beep test, the correlation in the first class is high and in the fourth class – low. Negative correlation means that the greater the body mass of the examined person, the worse the result in the sample obtained. During the shuttle run in the first class a high correlation was obtained and in the fourth class correlation between both variables was very high. In the test for trunk bends, very high correlations between the number of repetitions and

body weight were obtained in both classes. During the barbell bench press, a correlation was obtained, which means a full relationship between the body weight and the obtained result, i.e. the greater the body weight of the tested person, the better the result in the straight bench press.

Table 12. The influence of the level of body fat on the results of fitness tests

	Pull-ups	beep test	Torso bends	Shuttle run	Barbell press
class I	-0.65	-0.85	-0.91	0.80	0.82
class IV	-0.85	-0.67	-0.87	0.90	0.71

When trying to pull up on a high bar, a negative correlation was obtained in both cases, which means that the higher the level of body fat, the worse the result in the number of pull-ups. In the first class the correlation is high, while in the fourth class it is very high. In the beep test, the correlation between Fat % and the distance run is negative, very high in the first class and high in the fourth class. The strength of the relationship between adipose tissue and trunk slopes is very strong in the fourth class, while in the first class a full relationship was obtained between both variables. The results in the shuttle run in both cases mean that the correlation between Fat % and the obtained result is very high, i.e. the more body fat, the longer the time during the run. Bench press on a straight bench in the first class had a high relationship strength and in the fourth class it was very high.

Table 13. The influence of lean body mass on the results of fitness tests

	Pull-ups	beep test	Forward bends	Shuttle run	Barbell press
class I	-0.41	-0.52	-0.57	0.38	0.90
class IV	-0.34	-0.09	-0.69	0.71	0.81

The strength of the relationship between the number of repetitions achieved in pull-ups and lean body mass is negative, moderate in the first class and low in the fourth military class. During the beep test, the correlation is moderate at the beginning of education and weak, i.e. no connection in the last class. The test for the number of forward bends showed moderate strength in the first class and high strength in the fourth class. During the shuttle run, a low correlation was obtained in the first class and high in the fourth class between lean body mass and time obtained in the run. The barbell bench press in both cases obtained a very high strength of the relationship between the two variables.

Table 14. The influence of body fat mass on the results of fitness tests

	Pull-ups	beep test	Torso bends	Shuttle run	Barbell press
class I	-0.64	-0.86	-0.90	0.81	0.82
class IV	-0.76	-0.58	-0.88	0.92	0.80

The strength of the correlation in the pull-up test is negative and high in both groups, i.e. greater body fat mass will negatively affect the number of repetitions. In the beep test, the correlation is very high in the first class and moderate in the fourth class. During trunk bends, you can see a very high relationship between the number of repetitions achieved and body fat mass in both cases. In the shuttle run, the correlation is positive in both cases,

very high in the first class and in the fourth class there is a full dependence between the variables examined. In the barbell bench press test, the strength of the relationship is positive, and there is a very high relationship between the mass of adipose tissue and the maximum weight obtained in the test.

Table 15. The influence of muscle mass on the results of fitness tests

	Pull-ups	beep test	Torso bends	Shuttle run	Barbell press
class I	-0.41	-0.52	-0.57	0.38	0.90
class IV	-0.34	-0.09	-0.69	0.71	0.81

During the pull-up attempt, there was a moderate negative correlation in the first class and a low correlation in the fourth class between the number of repetitions and the muscle mass of the students. In the capacity test, the strength of the compound in the first class is moderate, while in the fourth class it is weak. The number of repetitions in trunk bends and the muscle mass of the study group had a moderate effect on the result in the first class, and a high one in the fourth class. In the shuttle run, the correlation is positive in both cases, low in class I and high in class IV. The barbell bench press in both cases obtained a very high strength of the relationship between the two variables.

Table 16. Influence of BMI on the results of fitness tests

	pull-ups	beep test	Torso bends	Shuttle run	Barbell press
class I	-0.53	-0.80	-0.85	0.70	0.84
class IV	-0.68	-0.42	-0.71	0.85	0.75

The strength of the relationship between the pull-up test and BMI is negative, moderate in the first class and high in the fourth class. During the beep test, the correlation in the first group is very high and in the second group it is moderate. The number of repetitions in trunk bends and BMI in the study group has a very high relationship strength in the first class and high in the fourth class. In the shuttle run, both groups present a positive correlation with a high and very high relationship between the two variables. Pressing the barbell on a straight bench in both cases has a positive correlation, in the first class the strength of the relationship is very high, while in the fourth class it is high.

Discussion

Physical fitness is a key factor that determines a healthy lifestyle. The term is understood in many ways, but these definitions share one common goal, which is to be fit. Physical fitness plays a particularly important role in military classes in high school. The task of classes with a military profile in Polish schools is to prepare young people for future service in various uniformed services, such as the army, police, fire brigades or other special services. When working in such professions, fitness is a factor that can save human lives, which is why performing fitness tests and constantly developing physical activity is a mandatory element. Examination of physical fitness has been conducted with the aid of the "physical fitness test of professional soldiers" used by the Polish Army, from which there were used 3 tests: pull-ups on a high bar, swing run and forward bends. In addition to the above-mentioned tests, the test included the "Beep test" and the barbell bench press. These studies helped to capture the

relationship between body composition and the level of selected motor skills, showed differences between the first and last military class and assessed the level of fitness of the surveyed military classes. When analyzing the body weight of the surveyed military classes, it is possible to notice the differences between the first and fourth military class. The average body weight of the subjects from the first class was 68.7 kilograms, while in the fourth class this value was 82.5 kg. This means that the difference between the two groups was less than 14 kilograms. As for the minimum and maximum values in both classes, the younger respondents reach a body weight of 54.0 to 80.4 kilograms, while the older respondents range from 68.8 to 101 kilograms. Cameron and Jason studied the physical fitness of the United States Air Force, during which they examined the body weight of soldiers. Their average value was 74.9 kilograms, the difference between the maximum and minimum body weight reached the result of 15 kg. Comparing the research results of authors from the United States with students of uniformed groups in Ležajsk, it should be stated that the average body weight of first-class students is lower, and higher in fourth-class students than US Air Force soldiers (Mackey & DeFreitas, 2019). Analyzing the results obtained with bioelectrical impedance, we can see differences in body composition components between first and fourth military class. The percentage of body fat at the beginning of education in the military classes ranged from 4.2% to 22.6% and its average was 12.4%, while in the last class it ranged from 8.2% to 24.7% with the average 16.9%. The average value of both groups was at the correct level and is within the standards for Fat % according to the World Health Organization. Considering the results of the research group, we can see that the level of body fat is higher in the last uniformed class. We can see the same relationship when analyzing other components of body composition. The average weight of fat in the first class is 9 kg and is 5 kg less than in the fourth class. If we take into account the lean body mass (FFM), the difference in the average is 9 kg in favor of the younger group of respondents. Comparing the muscle mass of the studied groups, we notice a difference in favor of the older uniformed class. The average muscle mass is 56.8 kg in the first class, while in the fourth class it is 65.4 kg and differs by 8.6 kg. Comparing the components of body composition from the uniformed groups in Ležajsk, research on military units of the Spanish Armed Forces should be shown. Bustamante-Sánchez and Clemente-Suárez (2020) studied 179 male aircrew members. The study consisted in comparing the body composition between soldiers piloting planes and soldiers who belonged to the crews of transport planes. The average body fat level of the pilots was 16.8% and that of the crew was 23.7%. As for the other components, the lean mass ranged from 58.7 to 63.95 kg in the case of the second group, and the difference between the muscle mass was almost 3 kg in favor of the pilots (Bustamante-Sánchez & Clemente-Suárez, 2020). The result of the pilots' body fat level is almost identical to the Fat % of students from the fourth uniformed class in the Secondary School, which was 16.9% and differed only by 0.1%. Thanks to electrical bioimpedance, the BMI values in both classes were examined. The average BMI value in the first military classes was 21.7 and in the fourth class it was 24.6. Both obtained results, despite the difference of 3.9 points, mean that the body weight of the subjects is correct in relation to body height. Mitchell et al. (2008) studied the body composition of US military medical students. The University of Uniformed Services requires that students present a high level of physical fitness and lead a healthy lifestyle with the principles of proper nutrition. At this college, all students are on active military service and are required to maintain a minimum level of fitness within specified military standards. 163 military medicine students in the last class were examined. Studies have shown that BMI increased by 5 percentage points between the first and last year of study. The average BMI value was 24.2 and remained within the standards required by the University of Uniformed Services (Mitchell et al., 2008). Comparing the results of American military students to students of military classes in Ležajsk, it should be noted that the body mass index BMI does

not differ significantly, because it is a difference of only 0.4%. The analysis of the results in the pull-up strength test showed that first-year students achieved better results than the military from the fourth class. The average of younger students' pull-ups was 7.5 repetitions, while in the case of their older peers this value was 6.2. Tomczak (2017) examined a group of Riflemen of the Rifle Unit 1313, in which 32 men took part. According to the author, the most important motor ability of a soldier, after endurance, should be the strength of the shoulder and back muscles. During the pull-up test, shooters performed an average of 4.39 repetitions (Tomczak & Klasa, 2017). Despite less experience in the army, students of uniformed groups in Leżajsk fared much better than the Riflemen of the Rifle Unit 1313. During abdominal bends, first-class students performed an average of 57.7 repetitions in two minutes, and fourth-class students performed 57.1 repetitions. These results are practically identical, so it can be concluded that the strength of the abdominal muscles in both classes is on the same level. The results of trunk bends of the "Shooters" in the study by Tomczak (2017) are worse than those of students from the High School, because their average is 52.2 (Asienkiewicz & Kwapisz, 2015). Asienkiewicz and Kwapisz (2015) conducted research on professional soldiers from the sapper battalion. The average number of repetitions in trunk bends at the age of up to 25 years was 57.7 (Fransson, 2020). Taking into account the results from the 10 × 10 m shuttle run, it should be stated that the younger uniformed men achieved better times than the older ones. Their average result was 30.5 seconds, while in the second group it was 31.3 seconds. A group of professional soldiers from the sapper battalion achieved a better result than the uniformed groups from Leżajsk, because their average was only 29.41 s (Fransson, 2020). Comparing these results, it should be stated that the group of sappers is characterized by better speed and agility abilities. The situation is different if we compare these results to the group of Riflemen of the Strzelecka Unit 1313. Their average during the shuttle run was 34.7 s, which is a much worse result than the military class from high school (Asienkiewicz & Kwapisz, 2015). During the endurance and oxygen test, the military classes from Leżajsk presented themselves worse than the studies of other authors. The average result in the first class was 1040 meters and in the fourth class 1015 meters. The differences are minimal, therefore, it should be stated that both groups present the same aerobic capacity during the beep test. Fransson (2020) studied a group of male recruits in the Swedish Armed Forces for aerobic fitness. During the beep test, the recruits obtained an average score of 10.8, which is equal to 1820 meters (Conkright, et al., 2020). Another author studied US soldiers from a US Army unit Ranger. In the beep test, the soldiers achieved an average result of 1680 meters (Conkright et al., 2020). Taking into account the results of research on a group of soldiers from different parts of the world, it should be stated that a group of students from the military class in Leżajsk should improve their performance capabilities, because they differ significantly in the average results. The correlation between body composition components and fitness tests in both military classes showed that higher body mass index, body fat, FFM, muscle mass and BMI had a negative impact on all the results in the performed tests, except for the barbell bench press. The level of body fat, body fat mass, body mass and BMI index influenced the most the results in the pull-up test, aerobic capacity, abdominal muscle strength and in the shuttle run. Higher body mass, lean body mass and muscle mass, however, are fully related to strength during the straight bench press. This means that the strength of the shoulder and chest muscles increases along with the components mentioned above. When it comes to comparing the two groups against each other, the first class performs better during pull-ups on the bar and in the shuttle run. The fourth class, on the other hand, achieved better results in the barbell press on a horizontal bench. Abdominal muscle strength and aerobic capacity during the beep test are similar in both study groups. Studies of special forces soldiers of the United States Army showed that lower levels of body fat and fat mass had a positive effect on the results in all tests (Mitchell et al.,

2008). Mendoza-Muñoz et al. (2020) investigated the influence of body mass components on the physical fitness of students. Body weight, BMI, body fat mass, Fat % and FFM were measured. It has been shown that a correct body weight contributes to obtaining better results in speed and agility tests. The results showed that a higher level of body fat, BMI and body fat mass negatively affected the performance test. There was also a direct relationship between speed and agility and body fat mass. The author's conclusions coincide with the results obtained during the study of uniformed groups from Leżajsk (Asienkiewicz & Kwapisz, 2015).

In conclusion, it should be stated that body composition components affect the results obtained during fitness tests. The surveyed military classes had no difficulties in performing fitness tests and their results do not differ from the values obtained in other regions of the world. Systematic physical activity related to the specificity of the military profile at the Secondary School in Leżajsk positively affects the body composition of uniformed groups.

Conclusions

The analysis of body composition components, physical fitness tests for speed, agility, endurance and strength, as well as the correlation between body composition and the results of fitness tests, implies the following conclusions:

- Bioimpedance showed higher values in all components of body composition among students of the fourth military class. These differences result from the specific nature of military profile classes. During the four-year education, students have contact with many specialist classes on which they build their physical fitness and the use of a high-calorie diet provides them with the necessary energy.
- The correlation between body composition and fitness tests showed that higher levels of body fat, lean body mass, BMI and body weight negatively affect the results obtained in pull-ups, trunk bends, shuttle runs and beep tests. Greater body weight, lean body mass and muscle mass positively affect the results of the barbell bench press. Maintaining a balanced diet and high physical activity will positively affect the balance between body composition and physical fitness of uniformed personnel.
- Differences in the results between the first and last military class were shown. The group of younger uniformed officers performs better during pull-ups on the bar and in the shuttle run, and the fourth class in the barbell bench press test. The forward bends of the torso and the results obtained in the beep test are at a similar level. Gaining muscle mass and strength exercises will positively affect the results of the barbell bench press in the group of first-class students. Older uniformed officers, on the other hand, should perform more exercises developing the strength of the shoulder girdle muscles.

List of acronyms

- BIA – Bioelectrical Impedance Analysis
- BMI – Body Mass Index
- FFM – Fat Free Mass
- FM – Fat Mass
- MM – Muscle Mass

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