



## SPORTS ACTIVITY AS A FACTOR DIFFERENTIATING THE LEVEL OF SOMATIC CONSTITUTION AND PHYSICAL FITNESS OF OFFICER CADETS AT THE MILITARY ACADEMY OF LAND FORCES

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### ABSTRACT

**Purpose.** Sport activities comprise the main forms of physical activity, which include sport disciplines and sport events. The main aim of the work is to evaluate the differentiation of the somatic constitution, physical fitness and the respiratory abilities in officer cadets of the Military Academy of Land Forces, depending on the level of their sports activity. **Methods.** The research material was gathered as a result of testing officer cadets of the Military Academy of Land Forces in 2014. The testing covered a research sample of 90 men. The mean age of the examined cadets was 22.9 years. Examinations of the students included anthropometric measurements, physical fitness tests, spirometry and a survey. **Results.** The results indicate the lack of significant differences in the body build characteristics of officer cadets. Only the body mass index was different. Separated groups of students, in terms of sports activity, were characterised by similar physical fitness and the different level of the efficiency of the respiratory system. The higher level of these respiratory abilities distinguished sports active officer cadets, in comparison with passive officer cadets. **Conclusions.** Sports activities in leisure time did not turn out to be a factor, which significantly differentiated the somatic characteristics of officer cadets. Sports activity was not also part of lifestyle, which significantly differentiated the level of the majority of the analysed functional and respiratory abilities. Only in the case of the cardio-respiratory efficiency, forced expiratory volume in 1 second, forced vital capacity, active cadets were characterised by a significantly higher level of these physiological abilities, in comparison with less active cadets.

**Key words:** sports activity, somatic constitution, physical fitness

### Introduction

Physical fitness of a man is conditioned by environmental and genetic factors. The impact of environmental factors is reflected both in the volatility of individual components of human motor skills and in the entire human behaviour [1]. The most crucial determinants of physical fitness, and thereby people's health, include lifestyle [2]. Lifestyle is understood as a set of behaviours, attitudes and overall philosophy of individual life. One can talk about lifestyle when there is a possibility for choosing behaviours, which are disclosed mainly in leisure time [3]. According to many authors, one of the most important factors in lifestyle is physical activity undertaken by humans, since it determines the health condition, well-being and quality of their life [4, 5]. Most researchers note a positive impact of physical activity on the biological development of man, and thereby, the level of his or her somatic characteristics and functional abilities, too [6, 7]. However, the significant determinant of the positive impact of physical activity is to carry it out on a systematic basis [8]. Too low level of the mentioned activity is the fundamental cause of morbidity and mortality. It is correlated with vascular and cardiac diseases, type II diabetes, osteoporosis, hyperglycaemia, and numerous cancers [9].

According to many researchers, sports activity is one of the main forms of physical activity [10, 11]. Although this kind of activity does not cover various forms of physical recreation, housework, gardening, walking, but it can be considered as one of the basic factors of a human's physical activity, which favourably affects the state of his health.

Research specifying the impact of sport training on the level of development of somatic characteristics was implemented by many researchers [12, 13]. Various authors claim that the statistically significant changes in the structure of somatic usually regard and its components [14]. The cases of change in the somatic structure, such changes in various systems function depend on the level of undertaken physical activity, are amply documented in scientific publications. In many studies, there were relevant dependences observed between sports activity and physical fitness [15, 16]. A very important research topic seems to be the time for sports activity, which, according to many researchers, determines changes of the morphological characteristics and physical fitness [17].

Sport and physical activity is an important and compulsory part for the people who connect their lives with the military system. The military speciality and the quality of execution of the service duties and tasks depend on the fitness level and physical preparedness. The execution of service duties could not be possible without an appropriate level of physical preparedness [18]. It is very

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important to motivate individuals to be active, which allows them to keep physical preparedness on an appropriate level and to develop physical abilities [19].

Therefore, the aim of the study was to assess whether the sports activities undertaken by officer cadets at the Military Academy of Land Forces differentiated somatic constitution, physical fitness and respiratory functional parameters. It was hypothesized that more the favourable somatic build, from a health point of view, and a higher level of physical fitness may be presented by students, who regularly practiced sport in the military academy (three years of undergraduate studies).

### Material and methods

The research material was gathered as a result of tests carried out among officer cadets studying at the Military Academy of Land Forces in Wrocław, at the Department of Management, in 2014. The testing covered a research sample of 90 men. Their average age was 22.9 years. The research included anthropometric measurements, physical fitness and spirometry tests. The measurements of basic somatic characteristics, i.e. height and weight, were carried out. The body height was measured with an anthropometer with an accuracy of 0.1 cm. The weight measurement was performed on a medical scale with an accuracy of 0.1 kg. On the basis of the above-mentioned height and weight measurement results, the body mass index (BMI) was calculated. The body composition was assessed based on the electric bioimpedance with the use of the Tanita body composition analyser SC-330. The weight of the body fat, the lean body mass, the muscle mass and the bone mass were specified as well. The level of physical fitness was determined using the following motor tests: running over a distance of 3000 meters (cardio-respiratory endurance), bent arm hang (functional strength), shuttle running 10 × 5 meters (running speed and agility), Flamingo balance test (body balance).

The following respiratory abilities were also measured: the forced expiratory volume in 1 second (FEV<sub>1</sub>), the forced vital capacity (FVC), and the peak expiratory flow (PEF). These measurements were conducted by means of the Pneumo RS type spirometer with an accuracy of 0.01 litres.

Measurements of the somatic characteristics as well as functional and respiratory abilities were carried out in sports facilities of the Military Academy of Land Forces. Students performed physical fitness tests in sports field uniforms, always in similar conditions.

A survey made it possible to obtain information about, among other things, a factor of lifestyle, which was undertaking sports activity by officer cadets in their spare time. That was specified on the basis of the number of leisure time activities declared by them:

- sports active officer cadets – practising various sports, at least three times a week (each time for at least 1.5 hrs.)

- sports passive officer cadets – practising various sports two, and less times per week (activity taken in each case for at least 1.5 hrs.) and representing passive forms of spending leisure time.

Statistica version 9.0 for Windows (StatSoft Inc., USA) was used for statistical analysis. The arithmetic mean, standard deviation and coefficient of variation were calculated, which were used to carry out the characteristics of the level of the selected somatic characteristics as well as functional and respiratory abilities of the subjects. The Shapiro-Wilk test was used to check the distribution of the examined variables for normal distribution. The *t* Student's test for independent samples was used, in order to determine statistically significant differences in the level of the selected morphological characteristics and physical abilities between sports active respondents and those who are less active in sporting. The level of significance  $\alpha = 0.05$  (statistically significant differences were determined when  $p < 0.05$ ).

### Results

Students who pursue sports actively in their leisure time constitute the majority of all the surveyed (Figure 1).

The largest percentage of all the officer cadets in their spare time practise middle-distance and long-distance running, whilst the smallest proportion of them – team sports games (Figure 2).

The level of the analysed somatic characteristics and functional and respiratory abilities of the examined men is presented in Table 1.

The teams of students, differentiated by virtue of sports activity, have a similar body build, as evidenced by the lack of statistically significant differences in the level of most of the analysed somatic characteristics

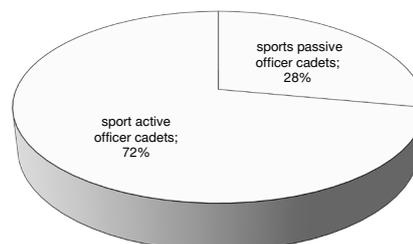


Figure 1. The percentage distribution of officer cadets according to their sport activity in leisure time

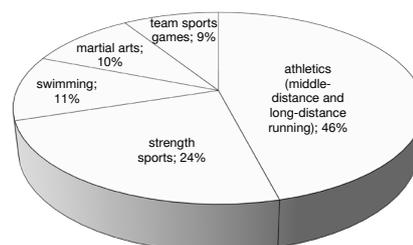


Figure 2. The percentage distribution of sports disciplines practised by the tested officer cadets in their leisure time

Table 1. General characteristics of the examined officer cadets

Variable	The total number of officer cadets		
	<i>M</i>	<i>SD</i>	<i>v</i>
Body height (cm)	179.39	5.30	2.95
Body weight (kg)	78.48	8.52	10.86
Weight of body fat (kg)	13.10	3.79	28.93
Lean body mass (kg)	65.38	5.60	8.57
Muscle mass (kg)	62.13	5.35	8.61
Bone mass (kg)	3.25	0.25	7.69
Body mass index (kg/m <sup>2</sup> )	24.47	2.14	8.75
Running 3000 m (s)	742.37	42.73	5.76
Bent arm hang (s)	49.44	13.50	27.31
Shuttle running 10 × 5 m (s)	19.08	1.18	6.18
Flamingo balance test (a number)	5.81	3.17	54.56
FEV <sub>1</sub> (l/s)	4.98	0.23	4.62
FVC (l)	6.08	0.26	4.28
PEF (l/s)	10.77	1.08	10.03

FEV<sub>1</sub> – forced expiratory volume in 1 second, FVC – forced vital capacity, PEF – peak expiratory flow

Table 2. The descriptive statistics of the selected somatic characteristics and functional and respiratory abilities of the examined officer cadets

Variable	Officer cadets sports active in leisure time ( <i>n</i> = 65)			Officer cadets less sports active in leisure time ( <i>n</i> = 25)			<i>t</i>	<i>p</i>
	<i>M</i>	<i>SD</i>	<i>v</i>	<i>M</i>	<i>SD</i>	<i>v</i>		
Body height (cm)	179.76	5.59	3.11	178.42	4.41	2.47	1.07	0.29
Body weight (kg)	77.76	8.75	11.25	80.35	7.62	9.48	1.30	0.20
Weight of body fat (kg)	12.68	3.41	26.89	14.18	4.52	31.88	1.71	0.09
Lean body mass (kg)	65.08	6.14	9.43	66.16	3.86	5.83	0.82	0.41
Muscle mass (kg)	61.85	5.86	9.47	62.88	3.69	5.87	0.82	0.41
Bone mass (kg)	3.23	0.28	8.67	3.28	0.18	5.49	0.77	0.44
Body mass index (kg/m <sup>2</sup> )	24.12	1.91	7.92	25.39	2.47	9.73	<b>2.59</b>	<b>0.01</b>
Running 3000 m (s)	720.77	25.71	3.57	798.52	21.49	2.69	<b>13.41</b>	<b>0.00</b>
Bent arm hang (s)	50.15	14.60	29.11	47.60	10.13	21.28	0.80	0.42
Shuttle running 10 × 5 m (s)	19.06	1.13	5.93	19.14	1.31	6.84	0.28	0.78
Flamingo balance test (a number)	5.58	3.14	56.27	6.40	3.21	50.16	1.10	0.28
FEV <sub>1</sub> (l/s)	5.02	0.19	3.78	4.87	0.27	5.54	<b>2.87</b>	<b>0.01</b>
FVC (l)	6.12	0.21	3.43	5.97	0.34	5.70	<b>2.54</b>	<b>0.01</b>
PEF (l/s)	10.88	1.08	9.93	10.47	1.04	9.93	1.61	0.11

FEV<sub>1</sub> – forced expiratory volume in 1 second, FVC – forced vital capacity, PEF – peak expiratory flow

the bold-face indicates the *t*-Student test values (when there is a statistically significant difference between intergroup mean values of a given trait) and *p* value (when *p* < 0.05)

(Table 2). Only in terms of the body mass index do officer cadets differ considerably. Students spending their free time actively are more slender compared to less active ones, which is reflected in their higher average body height and the lower body weight, and relative body mass index.

Despite the lack of statistically significant differences in the level of most of the morphological characteristics, active men are characterised by the slightly preferred composition of the body as compared to less active men. Irrespectively of the studied group, average values of coefficient of variation were found to be

lowest for body height, and higher as well as similar for lean body mass, muscle mass, bone mass, body mass index and body weight. The highest values of coefficient of variation were defined for weight of body fat.

The results concerning sports activities obtained by the distinguished groups of officer cadets throughout the study period clearly indicated the varying levels of the tested men's physical fitness and respiratory efficiency (Table 2). Those who practise sports actively had significantly higher levels of the cardio-respiratory endurance, the forced expiratory volume in 1 second and the forced vital capacity in comparison with less

active men. For the formed groups of cadets, average values of coefficient of variation were lowest for cardiorespiratory endurance, forced expiratory volume in 1 second, forced vital capacity and running speed and agility and higher or similar for peak expiratory flow and functional strength. They were highest for body balance.

### Discussion

Physical activity, including sport activity undertaken by a human, has a significant impact on the process of shaping the state of an individual's health and physical fitness. Various relations of physical activity with health make the former a desirable individual and social value [20, 21]. Currently, the phenomenon of the physical fitness decline can be observed in virtually every age group. This is a result, among others reasons, of low physical activity of people [22]. Consequently, this unfavourable trend leads to the increase in the society's incidence of the so-called civilization diseases (diseases of affluence), particularly cardiovascular and those related to metabolic disorders [23].

Analysis of the research results shows that sport activities did not differentiate the strength of the majority of selected morphological characteristics of various cadet groups. Only in the case of the body mass index, statistically significant difference was visible between the groups of respondents. Individuals who are active physically are much more slender compared to individuals who are passive and less active in their leisure time. The phenomenon of the lack of significant differences in strength of most of somatic characteristics, between the groups divided according to their declared sports activity conducted in their spare time, might be a result of training duration and exercise loads. Studies of the increased physical activity, including sport training, impact on the strength of morphological characteristics show that the effect of reducing the subcutaneous fatty tissue, thus reducing the overall fat mass, is distributed in time in young sportsmen. Statistically significant differences in this area occur not earlier than after two years of intensive sport training [14]. However, the research shown here confirms regularities observed by Kemmler et al. [17]. The researchers have proved that undertaking vigorous physical activity is essential for the body mass index of tested individuals. According to the authors, even the less intensive physical activity, that is occasional, short-lasting and performed recently, differentiates slim students from those with the excessive body weight.

Regarding the changes in human body structure, the subject of changes in the various systems' functions, depending on the undertaken physical activity intensity, is vastly documented in the scientific literature. Many studies observed relevant relationships between physical activity and physical fitness [24]. The authors reported the correlation between an increased risk of cardiovascular diseases, obesity and metabolic profile, with a lack

of physical activity [25]. The presented research shows that changes in the physical fitness intensity and the selected parameters of the respiratory system resulted from sport activity are different from changes in the somatic construction. The considerable variation in the level of most of the functional and respiratory abilities, i.e. cardio-respiratory efficiency, forced expiratory volume per second and forced lungs vital capacity, that has been observed, is the result of taking additional physical activity by men while studying at the Military Academy of Land Forces in Wrocław. Cadets who are active participants of sports have much stronger cardio-respiratory endurance, forced expiratory volume per second, and forced vital lungs capacity than less physically active cadets. The results of the study conducted by Sączuk and others [26], among students of the Faculty of Physical Education in Biała Podlaska, confirm the existence of the relation between the cardio-respiratory efficiency and regular physical activity.

### Conclusions

1. Sports activities undertaken in leisure time were not a factor differentiating body build of officer cadets. Only the body mass index was significantly greater in less than more active individuals. More favourable, from the health point of view, was the observation that most characteristics of body build, showing no significant differences between these two groups, were slightly smaller in more than less active cadets.

2. Sport-related activity also did not distinguish most of the functional abilities, except running for 3000 meters, where faster cadets turned out to be more physically active.

3. Respiratory abilities (FEV<sub>1</sub> and FVC) are significantly greater in more than less active cadets.

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