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The Influence of Urbanization Level of Residence on the Health-Related Fitness of University Students

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ABSTRACT

The aim of the study was to assess the influence of place of residence on the health-related fitness (H-RF) of university students from Kielce, Poland. The research included 632 first-year students from the Jan Kochanowski University in Kielce between 2015–2017. The research analyzed two basic components of H-RF – morphological and circulatory-respiratory. In terms of the morphological component, body height and weight, as well as BMI were measured. In terms of the circulatory-respiratory component, the $\dot{V}O_2max$ was calculated utilizing the Astrand test, that allows the assessment of $\dot{V}O_2max$ in l/min and $\dot{V}O_2max$ in ml/kg/min and PWC_{170}. Data regarding place of permanent residence of the students and physical activity in their free time was collected using a questionnaire. In this respect, the urban and rural environment were distinguished. Using the Vigorous Physical Activity index, two categories of physical activity in free time were distinguished, i.e. moderate and low. The obtained results indicate a differentiation of H-RF of the student, both in relation to the place of permanent residence and physical activity in their free time, that was slightly more pronounced in men than in women. This may denote that men are more eco-sensitive, meaning that they might be more susceptible to the influence of environmental factors.

Key words: *urbanization, environmental conditions, bioanthropology, health, physical fitness*

Introduction

In population studies, Health-Related Fitness (H-RF) is continually assessed. Health-Related Fitness describes the general physical condition of a person, which shows his/her multilateral adaptation to living conditions. This type of fitness is the basis of good health and enables one to achieve an optimal quality of life[1,2]. To be fit, according to Howley and Franks[2], means to be able to enjoy life to the full, with little risk of developing major health problems.

Physical fitness is related to the condition of the entire human body, not only its locomotor system. In other words, the ability to perform any motor activities that determine achievement of a person's potential. It is the result of the favorable and unfavorable influence of normal physical activity, being related to the level of health[3]. Hence, both physical fitness and physical activity in free time are included in the basic positive measures of health[4–6]. The idea of H-RF can be integrated into a comprehensive, holistic model of health, as well as into the theory of health training (prophylactic training), since the level of H-RF is a specific measure of positive health[4–6]. Concomitantly, cardiovascular fitness and the measurement of morphological components are considered crucial in the assessment of optimal health[7].

However, a review of the literature shows that little research has been carried out on university students in relation to H-RF[8,9]. Tests measuring H-RF are designed to motivate individuals in achieving both higher fitness levels, and healthy lifestyle changes. Moreover, such tests might also indirectly, measure positive attitudes and habits, self-esteem and self-control, Thus, H-RF tests can indicate where lifestyle changes might be necessary[1,10,11].

The commonly accepted concept of physical activity refers mainly to spontaneous activity of any kind chosen by the exerciser. Physical activity understood in this way

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is the focus of physical education, as well as health sciences and preventive medicine. This concern is especially due to technological reliance and sedentary lifestyles in children and adolescents globally[11].

Such cultural changes negatively impact on physical health, reducing the functional potential of children and adolescents. These aspects have been noted by several authors[11–13],who predict the biological degeneration of modern youth, who, although they are taller and healthy-looking, have reduced physical efficiency. Taking this into account, the assessment of the health condition of the younger generation – despite the lack of disease – cannot be optimistic.

A factor that most often stratifies a population is the degree of urbanization of the place of residence. Hence, the main goal of the study was to assess the influence of place of residence on health-related fitness of university students from Kielce, regarding two basic components – morphological and circulatory-respiratory. Additionally, leisure time physical activity was also included among the differentiating factors.

Materials and Methods

The research included 632 full-time students, 382 women and 250 men who had attended the Jan Kochanowski University in Kielce between 2015–2017. The average age of the surveyed students was 19.5 years, of which 64.5% came from urban areas (small, medium and large cities), and 35.5% from rural areas. The study group consisted of a majority of female students, (60.4% women and 39.6% men), being typical for this type of university[14].

During interviews, two groups of leisure time physical activity were distinguished, taking into account the weekly number of days on which the study participants performed at least 30 minutes (continuously or a total of at least 10 minutes-long activities) of physical activity: Vigorous Physical Activity (VPA) in free time indicator was used for this[15]. It was assumed that the recommended level for this indicator is highly intensive, and is predicated on frequent physical activity – 5 to 7 days a week with a duration of at least 10 minutes or longer. Out of the 5 categories of answers: 5–7 times a week, 3–4 times a week, 1–2 times a week, less than once a month and never, the following two categories were distinguished, due to the low level of physical activity of the surveyed students: moderate physical activity (3–4 days or more / week) and low physical activity (1–2 days or less / week).

To assess health-related fitness (H-RF), two components were taken into account[5,7]: morphological – in the form of body height, weight and BMI, which was calculated using Martin's technique where body height was measured with an anthropometer with an accuracy of 1 mm and body weight on a mechanical 'Seca' scale with an accuracy of 100 g; and circulatory- respiratory – i.e. VO_2max in l/min and $\dot{V}O_2$max ml/kg / min determined by an indirect method, using the Astrand test[16], in which exercise was performed in two steps on a Monark bicycle ergometer, starting with a 3-minute warm-up with a load of 50 W, then 5–6 minutes of exercise with a submaximal load in the range of 100–150W, so that the heart rate (monitored on a cardiomonitor) was set between 130 and 160 beats / minute. The VO_2max was calculated from the Astrand tables, taking into account the pulse rate from the steady-state period. The significance of differences between groups was assessed by t-student test for independent groups, assuming a significance level of 0.05 and higher.

Results

The majority of women (65%), both from urban and rural settings, showed low physical activity. Urban women (23.6%) were more active, compared to rural women (14.2%), while men, especially city residents, had both higher physical activity in their free time than women, and higher physical activity ($p < 0.05$) than their rural peers. Descriptive statistics of all trials are presented in Table 1. There are significant sex differences in all trials. Rural women were characterized by a slightly lower body height and a stronger body build in relation to urban women. Also, men who were permanent city dwellers, were, on average, significantly taller, and had a lower BMI, but not significantly different (Table 2). Both women and men from rural areas had significantly higher mean values of $\dot{V}O_2$max and $\dot{V}O_2$max, indicating a greater endurance capacity. Alternatively, physical activity in free time was a factor that differentiated these components of physical fitness only in men, favoring men with moderate physical activity level (Table 3).

Discussion and Conclusion

Rapid cultural changes over the last few decades have place unprecedented demands on people. These changes have impacted on both work and living environments in the developed world. Several studies show that decreasing physical activity contributes to declining physical health and susceptibility to diseases[5,13,17,18].

Furthermore, as a result of a general reduction in physical activity in developed countries, there has been a noticeable effect on the health and fitness levels of children and adolescents. Therefore, it can be argued that rapid technological and social changes taking place are reducing the functional potential of the young generation. This has been emphasized by various authors who show that while many modern youth are taller and healthy looking, are becoming less fit[13,17,18]. Taking this into account, the assessment of their health – despite the lack of disease – does not herald optimism.

The authors of the National Health Program[13,17,18] highlight that physical activity is essential for the proper development of physical, mental and social health of people of all ages. The optimal frequency of training sessions should be 3–5 times a week. Classes conducted 5 times a

TABLE 1

MORPHOLOGICAL AND CIRCULATORY-RESPIRATORY COMPONENTS OF HEALTH_ RELATED FITNESS (H-RF) OF STUDENTS FROM KIELCE

H-RF components	Males N = 250		Females N = 382		
	$\overline{X}$	s	$\overline{X}$	s	t
Body height [cm]	176.5	6.67	162.9	5.25	28.6*
Body mass [kg]	71.1	9.37	57.77	8.30	18.78*
BMI [kg/m^2]	22.8	3.07	21.78	3.33	3.89*
VO_2max [l/min]	2.9	0.53	2.27	0.41	16.82*
VO_2max [ml/kg/min]	41.8	7.20	39.84	7.27	3.33*

* p<0.001

TABLE 2

T-STUDENT TEST RESULTS FOR MORPHOLOGICAL AND CIRCULATORY-RESPIRATORS COMPONENTS OF H-RF IN RELATION TO STUDENTS' PLACE OF PERMANENT RESIDENCE

H-RF components	Males		Females	
	t	p	t	p
Body height [cm]	3.157	0.0322+	2.795	0.2137+
Body mass [kg]	4.355	0.0536–	4.764	0.0726–
BMI [kg/m^2]	1.358	0.0035–	3.652	0.0253–
VO_2 max [l/min]	0.647	0.0046–	0.567	0.0001–
VO_2 max [ml/kg/min]	7.342	0.0001–	5.632	0.0215–

"-" means that rural residents have greater values of this trait, "+" means that urban residents have higher value of this trait.

TABLE 3

MORPHOLOGICAL AND CIRCULATORY-RESPIRATORY COMPONENTS OF H-RF IN RELATION TO STUDENTS' PHYSICAL ACTIVITY IN LEISURE TIME

H-RF components	Males		Females	
	t	p	t	p
Body height [cm]	3.363	0.753	2.363	0.1534
Body mass [kg]	9.125	0.844	4.428	0.4538
BMI [kg/m^2]	4.779	0.038	14.779	0.6528
VO_2 max [l/min]	12.950	0.041	5.953	0.7540
VO_2 max [ml/kg/min]	4.355	0.005	9.355	0.4357

week bring a better effect than 3 times a week, albeit the difference is small[10,19]. On the other hand, classes twice a week did not bring a significant physiological effect, and such an intensity of physical activity is characteristic of the vast majority of the surveyed women and men.

The study participants showed a low level of physical activity, as only 1/3 of them, mainly men, undertook intense exercise 2–3 times a week or more often. This frequency of exercise is considered only satisfactory regarding the health and developmental needs of a young organism. On the other hand, the majority of the subjects, (> 65%) did not engage in extensive exercise, which was confirmed by the study results. Physical activity was rated high, i.e. level of exercise engaged by the study participants, leading to tiredness and perspiration, occurred as part of organized and spontaneous activity. The latter, however, is insufficient to maintain and improve health and physical fitness[10,19,20].

The lack of differentiation, with the exception of BMI in women (p <0.05), regarding the morphological compo-

nents, depending on the place of residence, suggests that while rural women may have stronger bodies than urban women, rural life is being influenced by urban adolescent lifestyles and dietary habits[14]. In the applied stress tests, which enable the assessment of the circulatory-respiratory components, as in other indirect tests, the association that occurs during submaximal effort between the state of physical capacity and the course of physiological functions (heart rate, oxygen consumption, etc.) is used. Lower values of physiological indices and lower energy costs during submaximal effort correspond to higher cardiovascular and respiratory efficiency[7,16,19]. For these reasons, the evaluation of the circulatory and respiratory components was based on the VO_2max indices determined in absolute and relative values.

The study results indicate that the social environment constituting the place of permanent residence (urban-rural), is a factor that minimally differentiates the circulatory-respiratory efficiency of youths. Women from the rural environment, compared to their urban peers, had a significantly higher VO_2max in l / min ($p < 0.01$), and men had a higher VO_2max in ml/kg/min ($p < 0.05$). This shows the greater endurance abilities of rural youths, which is noted in previous literature on the subject[6,14,18]. The literature emphasizes that rural inhabitants are characterized as having higher levels of physical endurance and strength, while the urban inhabitants are characterized by speed and agility.

A certain limitation of our research is that it refers only to the population of young people living in south-eastern Poland, located in economic zone B, which may indirectly affect the characteristics of their physical fitness resulting, inter alia, from access to infrastructure and environmental conditions of lifestyle. However, this does not limit the possibility of comparing the results to the general population in Poland and allows for comparisons to be made to identify the level of physical fitness of young people. Our research may constitute an important contribution to the creation of a nationwide diagnosis of the physical fitness of the population of young adults.

In the differentiation of the circulatory-respiratory components of health-related fitness of university students, permanent residence plays an important role, and to a much lesser extent physical activity in free time. The study results revealed that environmental differentiation of the morphological and circulatory-respiratory components of health related fitness were marginally higher in men than in women, and this also applied to physical activity in free time. This might be related to the greater eco-sensitivity of men, and therefore, their greater susceptibility to the influence of environmental factors. Due to the low level of physical activity of students in their free time, it is socially desirable to develop and implement physical activity recreational programs as part of students' academic curricula. Health-related fitness is essential for adult physical and mental well-being. Consequently, low level of H-RF is a risk factor for pathological conditions, as well as reduction in work efficiency.

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UTJECAJ URBANIZACIJE NA FIZIČKU KONDICIJU I ZDRAVSTVENO STANJE STUDENATA

S A Ž E T A K

Cilj istraživanja bio je procijeniti utjecaj mjesta stanovanja na fizičku kondiciju povezanu sa zdravljem (H-RF) studenata sveučilišta iz Kielcea, Poljska. Istraživanje je obuhvatilo 632 studenta prve godine sa Sveučilišta Jan Kochanowski u Kielceu između 2015.–2017. U istraživanju su analizirane dvije osnovne komponente H-RF – morfološka i cirkulacijsko-respiratorna. Što se tiče morfološke komponente, mjerene su tjelesna visina i težina te BMI. Što se tiče cirkulatorno-respiratorne komponente, $\dot{V}O_2$max izračunat je korištenjem Astrand testa, koji omogućuje procjenu $\dot{V}O_2$max u l/min i $\dot{V}O_2$max u ml/kg/min i PWC170. Anketnim upitnikom prikupljeni su podaci o mjestu stalnog stanovanja učenika i tjelesnoj aktivnosti u slobodno vrijeme. U tom pogledu razlikovale su se urbana i ruralna sredina. Pomoću indeksa intenzivne tjelesne aktivnosti izdvojene su dvije kategorije tjelesne aktivnosti u slobodno vrijeme, umjerena i niska. Dobiveni rezultati upućuju na razlike u fizičkoj kondiciji studenata s obzirom na mjesto stalnog stanovanja i na tjelesnu aktivnost u slobodno vrijeme, koja je bila nešto izraženija kod muškaraca nego kod žena. To može značiti da su muškarci ekološki osjetljiviji i podložniji utjecajima čimbenika iz okoliša.