

Estimation of nutritional status of conscript soldiers from years 1994–2007

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Abstract: The aim of this work was estimation of the nutritional status of young men beginning compulsory military service in units located all over Poland. This assessment was carried out in the years 1994-2007. Average age of the examined men living in cities ranged from 19.9 ± 1.6 – 21.9 ± 1.3 . Body mass of the examined subjects ranged from 67.3 ± 9.3 kg – 74.3 ± 7.3 kg, while body height ranged from 175.1 ± 6.6 cm – 179.1 ± 6.3 . Average BMI value of recruits coming from both the cities and from the country was similar, and stayed within the normal range. BMI value of men coming from cities ranged from 21.4 ± 2.2 kg/m² – 23.4 ± 7.5 kg/m² -while values of those coming from the country ranged from 21.7 ± 2.5 kg/m² – 23.5 ± 3.1 kg/m². The occurrence of body mass disturbances, both underweight, overweight and obesity among young men beginning military service is a result of improper eating habits at home. The revealed high percentage of overweight and obese recruits may significantly limit the soldiers' physical efficiency, and impede both the training process and the possibility of perfect fulfilment of military tasks, and thereby the soldiers' combat abilities.

Key words: conscript soldiers, overweight, obesity, cities, country

INTRODUCTION

As a result of many epidemiological, experimental and clinical observations, it was found that improper nutrition causes metabolism disorders, and may be a reason for many metabolic diseases [1].

The status resulting from usual food intake, absorption and utilization of nutritive elements included in food, as well as pathogens activities influencing these processes are called nutritional status [2]. Both excess and shortage of energy and nutritive elements in daily meals unprofitably affect nutritional status. Long-lasting unbalanced alimentation always leads to health disturbances, including nutritional status disorders. Specific nutritional status disorders may be caused by deficient or excessive energy intake with food, lack of adequate amount of nutritive elements, improper ratios between these elements and inappropriate eating habits. Improper alimentation leads to the occurrence of many metabolic diseases, such as diabetes, atherosclerosis, arterial hypertension, as well as overweight and obesity [3]. Therefore, the estimation of nutritional status permits the indirect assessment of alimentation correctness, especially when conducted as collective nutrition.

During last two decades, a significant increase in human body mass has been noticed worldwide as well as in Poland. It is forecasted that the problem with overweight and obesity will become more and more serious. Currently, every third Pole indicates overweight, 14% of the population is obese, and 5% is underweight [4]. Underweight, overweight and obesity occurrence, in many cases, results from dysorexia that might be caused by emotional problems or lack of ability to deal with stress [5]. Individual tendency to obesity may be determined by genetic factors and environmental determinants. However,

it is not genes that are responsible for the obesity epidemic, but environmental determinants that create favourable conditions for excessive consumption and low physical activity. Factors such as abundance of food and easy access to it, a sedentary lifestyle (computer, TV, etc.), driving a car instead of walking, insufficient physical education in schools, or low physical activity are considered as the main reasons for the spread of overweight and obesity. The choice of lifestyle is a personal decision, nonetheless, it is made under specific external conditions that can be shaped in order to allow the choice of healthy behavior, and its fulfillment should be easily accessible, safe, inexpensive and convenient [6]. The aim of this work was estimation of the nutritional status of young men beginning compulsory military service in units located all over Poland. The assessment was carried out in the years 1994–2007.

MATERIAL AND METHODS

A total of 2,051 young men beginning military service in different units underwent estimation of their protein-caloric nutritional status. Before enrolment, 47.7% of the examined subjects lived in cities, while 52.3% came from the country. Anthropometric measurements were carried out. The body mass and body height of every man were measured. Obtained results formed the basis from which the Body Mass Index (BMI) was calculated. Based on this index, according to the Ferro-Luzzi classification [7], the examined men were classified into the following groups: underweight (BMI 17.0-18.4 kg/m²), overweight (BMI 25.0-29.9 kg/m²), obese (BMI –30.0-39.9 kg/m²) and normal body mass (18.5-24.9 kg/m²). Based on the measurements of arm circumference and selected skin fold thickness (biceps, triceps, under scapula and over the iliac) the percentage of fat content was calculated [8]. Chi squared test was used to compare the groups between recruits from cities and from the country. Statistical significance was set at $p < 0.05$ [9].

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Received: 4 November 2010; accepted: 15 December 2010

RESULTS AND DISCUSSION

The average age of the examined men living in cities ranged from 19.9±1.6 – 21.9±1.3. The body mass of the examined subjects ranged from 67.3±9.3 kg – 74.3±7.3 kg, while body height ranged from 175.1±6.6 cm – 179.1±6.3 cm. The average age of recruits from the country was similar to that of recruits from cities, and amounted to 19.8±1.3 – 21.8±1.2 years old. The lowest body height was 174.6±6.2 cm, whereas the highest was 177.4±6.4 cm, while body mass came within 67.8±8.5 kg and 72.9±9.1 kg.

Table 1 Mean values of age, body height and body mass of recruits from cities and the country within the years of examination.

Year of examination	Dwelling place	Age [years]	Body height [cm]	Body mass [kg]
1994	City	20.5±1.1	179.1±6.3	74.3±7.3
	Country	20.4±0.9	177.4±6.4*	72.9±9.1*
1996	City	20.0±1.1	176.9±5.8	67.3±9.3
	Country	20.0±1.0	176.4±6.2	67.8±8.5
1997	City	20.3 ±1.1	175.7±5.6	69.1±9.0
	Country	20.2±1.2	174.6±6.2*	70.2±9.3
1999	City	19.9±1.6	176.7±6.2	73.0±9.9
	Country	19.8±1.3	175.9±6.3*	71.7±10.8*
2000	City	20.7±1.6	175.1±6.6	72.6±6.6
	Country	20.0±1.1	176.8±6.8*	72.1±4.4
2002	City	21.0±1.5	176.4±6.5	71.4±9.9
	Country	20.6±1.3	175.8±5.5	71.7±8.8
2003	City	21.2±1.4	177.5±6.2	72.4±10.5
	Country	20.9±1.2	176.4±5.4	71.7±10.2
2004	City	21.9±1.3	177.3±7.3	71.5±8.1
	Country	21.8±1.2	175.1±5.9*	71.3±8.0
2005	City	21.4±1.3	177.5±6.4	73.0±6.4
	Country	21.3±1.2	176.6±5.9*	73.6±10.6
2007	City	20.4±1.8	176.9±6.2	71.6±10.3
	Country	20.0±1.3	176.2±6.9	70.0±6.9

* difference statistically significant between soldiers from cities and the country at p≤ 0.05

Average BMI value of recruits from both the cities and from the country was similar, and remained within the normal range. The BMI value of men from cities ranged from 21.4±2.2 kg/m² – 23.4±7.5 kg/m², while values of those from the country ranged from 21.7±2.5 kg/m² – 23.5±3.1 kg/m². It was found that the mean value of BMI of recruits living in the country was statistically higher in 1997 and 2004, in comparison to recruits living in cities, and the value of fat content was lower in 2007 (Table 2).

Detailed analysis of the obtained results revealed that in particular years a part of the examined men beginning military service were underweight. Comparison of the percentage of underweight recruits in both groups, living in cities and the country, allowed the presentation of statistically significant differences (Figure 1). The highest percentage of underweight recruits was found in 1996 among those from cities, and amounted to 12.9%, while the lowest percentage of 1.3% occurred in 2004. Among men from the country, the highest percentage of underweight was found in 1996 (8.8%), and the lowest (0.6%) in 2005. It should be stressed that in 2007, among recruits coming from cities, no underweight was found. Among recruits from the country, underweight was not found in 1994 nor in 2004.

Table 2 BMI value and fat percentage of recruits from cities and the country.

Year of examination	BMI (kg/m ²) value		Fat content (%)	
	City	Country	City	Country
1994	23.2±1.7	23.1±2.1	12.6±3.2	12.9±2.9
1996	21.4±2.2	20.0±1.0	13.7±4.1	13.6±3.7
1997	22.5±2.8	23.1±2.8*	13.1±1.3	13.0±3.9
1999	23.4±2.9	23.0±2.9	14.0±4.6	13.9±4.4
2000	23.6±4.0	23.0±2.9	16.0±5.3	15.2±3.9
2002	23.4±7.5	23.1±2.5	12.6±3.6	12.2±3.8
2003	22.7±3.1	23.0±4.1	13.8±4.4	13.1±4.1
2004	22.8±2.6	23.2±2.5*	12.9±4.2	12.4±3.4
2005	23.2±3.3	23.5±3.1	14.3±4.9	14.7±8.4
2007	22.7±3.0	22.5±2.8	15.8±4.4	14.1±4.3*

* difference statistically significant between soldiers from cities and the country at p≤ 0.05.

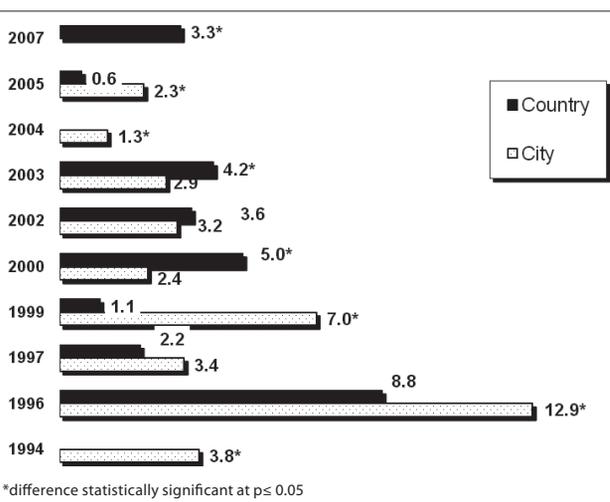


Figure 1 Percentage of recruits from cities and the country, indicating underweight.

In recruits coming from cities the highest percentage (32.5%) of overweight men was found in 1999, the lowest (11.5%) in 2007. Among recruits from the country the highest percentage (23.9%) of overweight men was found in 2005, the lowest (11.5%) in 1996. Statistically significant differences between both groups were found in 1994, 1999, 2002, 2005 and 2007.

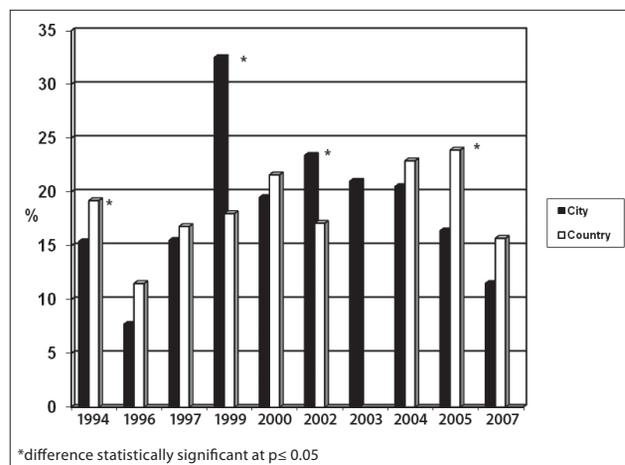


Figure 2 Percentage of recruits from cities and the country, indicating overweight.

In the first 3 examinations the presence of obesity among city dwellers was not found at all. Further research revealed that percentage of obese men ranged from 1.3% in 2004 to 9.8% in 2000. Obesity occurrence in men from the country was lower and ranged from 0.8% in 2007 to 4.5% in 2005.

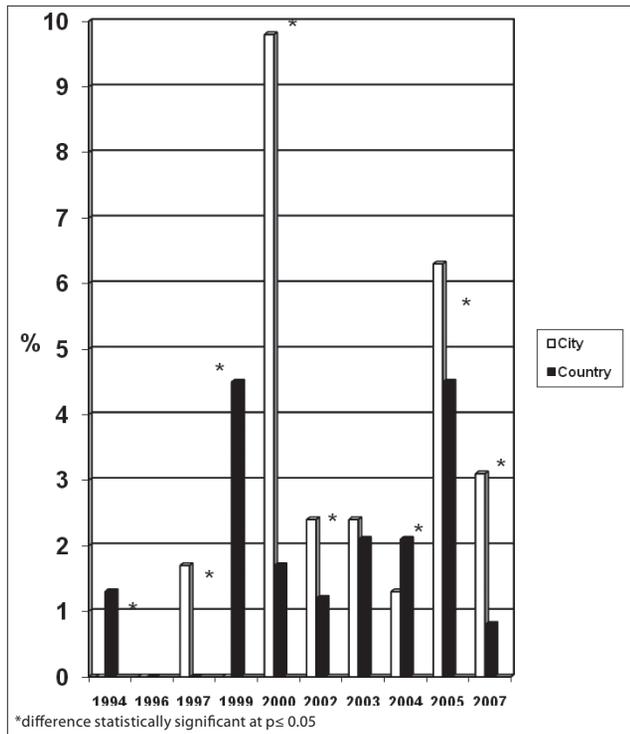


Figure 3 Percentage of recruits from cities and the country, indicating obesity.

Overweight and obesity resulting from improper eating habits, not only worsen physical and mental states, but also cause health and social problems related to the limitation of the possibility to perform a professions, including military service. Therefore, the estimation of nutritional status is not only an important element of the assessment of health status, but also determines predispositions towards military service in different types of military units [10].

Arm circumference of recruits from the cities ranged from 29.0 ± 2.8 cm (1997) to 30.2 ± 3.2 cm (1999) (Table 3). Skin fold thickness on the biceps was within the range of 2.49 ± 0.38 mm – 3.81 ± 1.21 mm, depending on examination period. The range of skin fold thickness on the triceps was wider, and ranged from 2.68 ± 0.43 mm (2004) to 5.81 ± 2.19 mm (1994). It should be underlined that this skin fold thickness decreased within the years of examination. The lowest skin fold thickness under the scapula was noted in 1994 (10.21 ± 3.10 mm), the biggest in 2000 (14.56 ± 6.95 mm). Within the years of examination the skin fold thickness over the iliac increased from 10.36 ± 3.89 mm (1994) to 21.84 ± 10.07 mm (2007).

Arm circumference of recruits from the country ranged from 29.0 ± 2.8 cm (2000) to 29.8 ± 2.9 cm (2002) (Table 3).

Skin fold thickness on the biceps ranged from 2.48 ± 0.34 mm (2004) to 4.41 ± 1.74 mm (1996) and on the triceps – from 2.72 ± 0.44 mm to 6.12 ± 2.14 mm. Thickness of m/a skin folds decreased within the years of examination. The lowest skin fold thickness under the scapula of 10.79 ± 3.76 mm was noted in 2002, and the highest of 12.47 ± 4.74 mm in 2000. Skin fold thickness over the iliac increased from 10.42 ± 3.89 mm in 1994 to 18.30 ± 9.88 mm in 2007.

Table 3 Selected skin folds thickness in young men, living in cities, and beginning military service.

Year	Arm circumference	Biceps [mm]	Triceps [mm]	Under scapula [mm]	Over iliac [mm]
1994	29.4 ± 2.1	3.81 ± 1.21	5.81 ± 2.19	10.21 ± 3.10	10.36 ± 3.90
1996	29.1 ± 3.2	4.51 ± 1.92	5.63 ± 2.66	11.47 ± 4.11	12.87 ± 5.96
1997	29.0 ± 2.8	3.57 ± 1.39	4.49 ± 2.51	11.49 ± 4.39	13.66 ± 7.68
1999	30.2 ± 3.2	3.41 ± 0.68	3.71 ± 0.65	12.43 ± 5.41	15.99 ± 8.76
2000	29.5 ± 4.0	3.90 ± 0.65	4.22 ± 0.61	14.56 ± 6.95	18.77 ± 11.1
2002	29.8 ± 3.3	2.79 ± 0.49	3.37 ± 0.68	10.93 ± 4.22	13.59 ± 6.48
2003	29.7 ± 3.5	2.83 ± 0.47	3.18 ± 0.51	12.45 ± 4.87	16.56 ± 8.69
2004	29.5 ± 2.7	2.49 ± 0.38	2.68 ± 0.43	12.20 ± 4.47	14.18 ± 6.95
2005	29.8 ± 3.7	2.53 ± 0.40	2.77 ± 0.41	12.83 ± 0.41	18.49 ± 10.05
2007	29.3 ± 2.8	2.83 ± 0.45	3.11 ± 0.57	13.13 ± 5.53	21.84 ± 10.07

Table 4 Skin folds thicken in recruits from the country.

Year	Arm circumference	Biceps [mm]	Triceps [mm]	Under scapula [mm]	Over iliac [mm]
1994	29.3 ± 2.6	3.65 ± 0.96	6.12 ± 2.14	11.00 ± 3.42	10.42 ± 3.89
1996	29.6 ± 2.5	4.41 ± 1.74	5.74 ± 2.58	11.14 ± 3.50	12.30 ± 5.36
1997	29.3 ± 2.6	3.44 ± 1.00	3.96 ± 1.27	11.60 ± 8.45	13.47 ± 6.96
1999	29.6 ± 3.1	3.32 ± 0.61	3.67 ± 0.82	12.10 ± 5.44	16.04 ± 8.63
2000	29.3 ± 2.9	3.88 ± 0.55	4.30 ± 0.56	12.47 ± 4.74	17.54 ± 9.09
2002	29.8 ± 2.9	2.82 ± 0.53	3.43 ± 0.60	10.79 ± 3.76	12.86 ± 6.02
2003	29.3 ± 2.9	2.84 ± 0.51	3.23 ± 0.59	11.73 ± 4.64	14.91 ± 8.07
2004	29.2 ± 2.8	2.48 ± 0.34	2.72 ± 0.44	11.81 ± 4.52	13.25 ± 5.32
2005	29.9 ± 2.9	2.17 ± 1.89	2.73 ± 0.44	12.40 ± 5.59	18.44 ± 9.62
2007	29.0 ± 2.8	2.82 ± 0.41	3.09 ± 0.53	11.64 ± 4.78	18.30 ± 9.88

In available literature, there are few reports concerning the assessment of the nutritional status of military recruits.

Using anthropometric methods, the nutritional status of 77 soldiers was assessed at the beginning of their military service in an anti-aircraft defence unit of the Polish Army. It was found that 40.2% of the recruits were characterized as being underweight and 26% overweight, while 13% was obese [11].

Comparison of body weight and total fat of men and women entering the US Army in the period 1978-1998 showed an increase in both parameters. Body weight of 1998 recruits, both men and women, was greater than in 1978 and 1983, and increased from 12 and 6% to 8 and 7%, respectively. Fat content in recruits' bodies also increased by about 15% for men and 5% for women between 1978 and 1998 [12].

Results of US Air Force recruits nutritional status showed that the prevalence of overweight/obesity increased nearly 24%, from 14.8% in 1996 to 18.3% in 2000. The increase in overweight/obesity was particularly large among male recruits aged 25-29 (i.e., from 36.4% to 44.5%) between 1996 and 2000 [13].

Information from the Walter Reed Army Institute of Research from May 2010 states that the proportion of potential recruits who failed their physical tests because of overweight has jumped nearly 70% since 1995. Obesity disqualified more potential recruits for military service [14].

Students come within a similar age group to soldiers beginning military service. Research carried out in years 1989-1995 among students from the Łódź region in Poland showed that within those years the number of overweight and obese persons increased [15].

Research on the nutritional status of 4,153 persons carried out by Szponar [16] revealed that in the group of men aged 19-29, 2.2% indicated underweight, 65.9% normal BMI, 27.6% overweight, and 4.3% obesity. These values differentiated, depending on the place of residence of the examined subjects. Normal BMI was found in 68.8% of men from cities and 61.3% from the country. Overweight was found in 23.1% of men living in cities and 34.9% of country dwellers. Obesity was found in 4.6% of men from cities and 3.8% of those from the country.

CONCLUSIONS

1. The occurrence of body mass disturbances, both underweight, overweight and obesity among young men beginning military service is a result of improper eating habits at home, which was connected with the economic situation in the family.
2. In connection with the professionalization of the Polish Army it is necessary to perform large-scale actions in dietary education and dietary prophylaxis of metabolic civilisation diseases among soldiers performing regular military service.

ACKNOWLEDGEMENT

This work was supported by Ministry of Science and Higher Education (Grant No. OR 00000909).

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