

# THE RELATIVE FAT MASS LEVEL AMONG THE YOUNG ATHLETES RESEARCHED IN 2006 AND 2008

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## Abstract

The objective of the study is to assess the level of fat mass established using a bioelectrical impedance analysis in a group of juniors of the Wielkopolska region team, for whom in 2006–2008 a programme was implemented in order to improve the level of basic morphological parameters and establish overall physical fitness. The study used the results of body composition measurements of boys and girls taking part in 22 sports disciplines, gathered in the Wielkopolska Sport Association. The participants were a junior team of Wielkopolska macroregion in 2006 and 2008. Body composition was assessed using a bioelectrical impedance analysis (BIA).

Results and conclusions:

1. The level of fat content in both analysed groups of female athletes exceeds the upper limit set for girls at this age (16–20%), and girls with excessive fat mass accounted for over 50% of total number of participants. A higher level of fat mass can be linked to a diet which is too calorie rich and with a period of life of the studied girls.
2. The size of fat component of the studied participants was below the lower limit set for the population at this age. More than 70% of boys doing various sports are characterised by fat mass below the standard.
3. Two years of co-operation between research units of the University School of Physical Education and instructors and coaches of the WSS have received morphological results. In case of girls in 2008 a slight lowering in the level of fat mass was noted, and in the group of boys a smaller number of people with lowered and increased value of relative fat mass was noted; additionally, an increase was noted in the number of athletes with a normal level of this component.

**Key words:** *fat mass, children and youth sport*

## Introduction

The issues of intragroup differences in athletes representing various sport disciplines have been discussed extensively in the literature. A particularly interesting question for an anthropologist, coach or physical education teacher is the assessment of the effects of physical loads on a human body (Burdukiewicz, Janusz, 1995; Latin et al., 1994; Malina, 1980; Pietraszewska, 1998; Roemmich, Sinning, 1996; Skład et al., 1995; Shephard, 1995). Developing detailed somatic descriptions taking into consideration not only body shape and proportions, but also body tissue composition, creates an opportunity to carry out comparative analyses of body morphology of athletes of various specialties, and the results obtained in this way may be the basis for development of criteria for somatic selection (Burdukiewicz, 2001; Pietraszewska, 1998). Pietraszewska (1998) and Burdukiewicz (2001) and other authors emphasise that some body build features are particularly useful in a given discipline or competition, thus their diagnostic value is higher than that of others. The researchers unanimously claim that the effect of training contributes to change in relations between tissue components: reduction of fat tissue and muscle growth.

Therefore, in many sport groups there are programmes in place to control weight and body components in order to increase the effectiveness of training work.

## Aim

The objective of the study is to assess the level of fat mass established using a bioelectrical impedance analysis in a group of juniors of the Wielkopolska region team, for whom in 2006–2008 a programme was implemented in order to improve the level of basic morphological parameters and establish overall physical fitness.

## Methodology

The study used the results of body composition measurements of boys and girls taking part in 22 sports disciplines, gathered in the Wielkopolska Sport Association (Wielkopolskie Stowarzyszenie Sportowe – WSS). The participants were a junior team of Wielkopolska macroregion in 2006 and 2008. In total 735 male and 478 female athletes aged 15–18 years were tested. Since 2006, at the request of the Wielkopolska Sport Association, a programme has been implemented aiming to assess the level of basic morphological parameters and to establish overall physical fitness. The programme was carried out by staff members of the Chair of Anthropology and Biometrics and the Department of the Theory of Sport of the University School of Physical Education in Poznań. The measurements were carried out twice a year. Each time methodological and scientific conferences were organised for coaches and instructors gathered in the Wielkopolska Sports Association, during which the results of the studies were presented.

In the analysis of the material the results of tests of young athletes with training experience of more than 3 years were used. Basic morphological features: height and weight were measured. Body composition was assessed using a bioelectrical impedance analysis (BIA). This method is characterised by a sufficient precision and reliability, and due to a short measurement time and moderate cost it is often used in scientific studies. For the assessment of body composition an Italian Akern – BIA 101 analyser was used. Fat mass, fat free mass and water content were established. The level of body components was presented as a percentage of total weight. The material was analysed using basic statistical methods, and comparing the level of fat mass established in 2006 and 2008. In the study the standard for fat component of the used analyser was used. The results were presented in tables, separately for boys and girls, divided by date of measurements. The Mann-Whitney U test was used for the comparison of quantitative variables and for categorical variables a two-proportion test was used. All statistical calculations were carried out in Microsoft® Excel 2000.

## Results

The basic statistical measures of the results of analysed characteristics were presented in table 1. They indicate that mean values of relative fat mass in the studied girls are significantly higher, both in girls studied in 2006 and in 2008, than it was noted in the group of boys. What is more interesting, the level of relative content of this component in both analysed groups of athletes exceeds the upper limit established for girls at this age (16–20%). Taking into account the fact that the participants are people with a very high level of physical activity, it was expected that the fat free mass component, not the fat mass component, will exceed the limits established for this component. However, the results were different. The comparative analyses of mean values obtained in 2006 and 2008 (Table 3) were however slightly optimistic. Such a statistical procedure indicates that in

2008 the number of people with excessive body weight was lower. It was also noted that in the analysed period the number of girls characterised by fat mass the mean values of which are below the standard increased.

In the studied group of boys the relative level of fat mass was a property with a negative deviation (Table 2). The value of the mean is below the lower limit of the property established for the population at this age (generated by Akern 101). This is manifested in the results obtained in 2006 and 2008. It turned out that in 2006 over 70% of boys engaged in various sports were characterised by fat mass below the standard. In 2008 on the other hand, lower values of the parameter in question were noted than in 2006, and at the same time the groups of people distinguished due to the level of fat mass are different (Table 3). The number of people with a lowered and increased value of relative fat mass slightly decreased, and the number of athletes with a normal level of this component increased.

In the further analysis of the results a comparative description of the level of relative fat mass was carried out in groups of people engaged in the same sport. A question was asked: do annual methodological conferences with sport coaches and instructors gathered in the Wielkopolska Sports Association, where the results of studies are presented and discussed and

changes in training means are suggested, have effects in the form of reduction in the level of fat tissue and increase in the level of fat free body mass in athletes? For this the values of the discussed component were analysed in athletes engaged in the same discipline. Because of the small number of people the analysis was carried out for athletes of 13 disciplines which were studied in 2006 and 2008. In the group of girls 10 teams were analysed in statistics of results. The comparative analyses were very interesting. Both in case of boys and girls a lowering in the level of relative fat mass was noted (Fig. 1, Fig. 2). The exceptions are four men teams and three women teams in which a slight increase in the discussed parameter was noted. The men

**Table 1.** The statistical characteristic of researched girls' body composition elements

Characteristic	below norm (%)	norm (%)	above norm (%)
Girls 2006 y.	16.75	23.04	60.21
Girls 2008 y.	19.51	28.57	51.92
Boys 2006 y.	70.96	17.07*	11.97*
Boys 2008 y.	67.08	25.94*	6.98*

\* significant differences at the level of 0.05

**Table 2.** The statistical characteristics of researched boys' body composition elements

Characteristics	2006 y. n = 235				2008 y. n = 243			
	M	SD	MIN	MAX	M	SD	MIN	MAX
Body weight (kg)	58.66*	9.17	36.50	92.0	56.22*	8.87	22.60	85.40
Body FAT (%)	21.63*	5.97	5.80	37.40	20.23*	5.94	6.00	37.80
Lean Body Mass (%)	78.37*	5.97	62.60	94.20	79.77*	5.94	62.20	96.00
Water (%)	57.66*	5.20	45.90	74.60	58.71*	5.19	45.50	68.00

\* significant differences at the level of 0.05

**Table 3.** The characteristic of the researched athletes taking into account fat mass level

Characteristics	2006 y. n = 366				2008 y. n = 369			
	M	SD	MIN	MAX	M	SD	MIN	MAX
Body weight (kg)	68.62	11.36	32.00	118.00	68.72	9.48	56.30	90.10
Body FAT (%)	12.53*	4.97	0.70	30.70	10.01*	5.30	5.00	23.00
Lean Body Mass (%)	87.47*	4.97	69.30	99.30	89.99*	5.30	77.00	95.00
Water (%)	65.32*	4.36	50.70	80.50	66.36*	4.19	56.40	71.40

\* significant differences at the level of 0.05

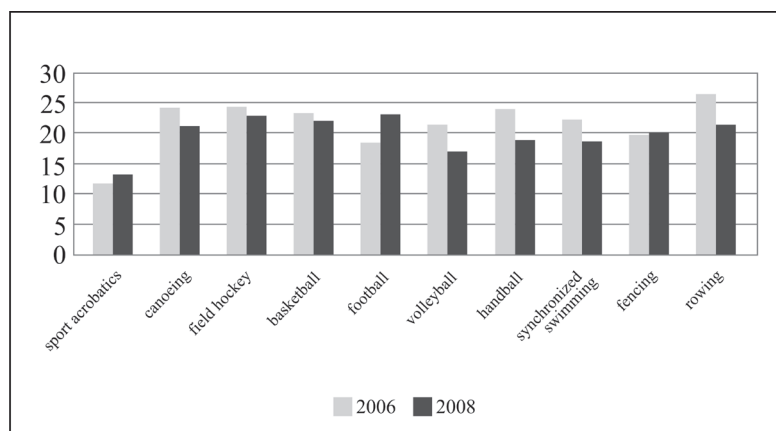
disciplines include: acrobatic sport, boxing, rugby and field hockey. A slight increase in fat mass in women teams was noted in acrobatic sport, fencing and football. It may be assumed that the discussions with coaches and athletes themselves or anxiety before another test are reasons for a slight lowering in the fat mass in young athletes' bodies.

## Discussion

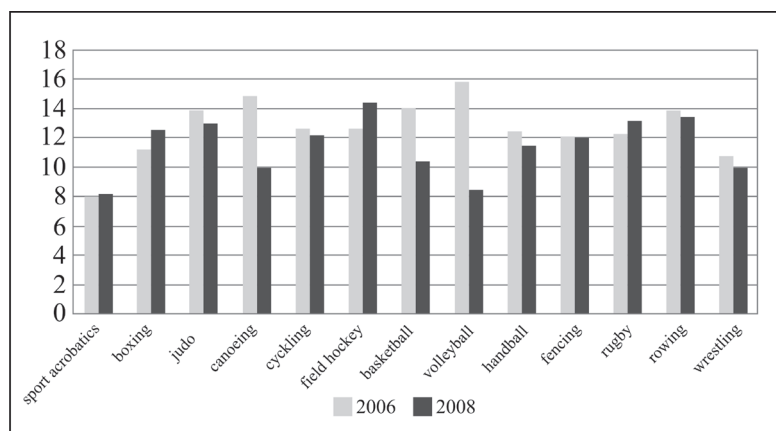
From the point of view of sports training the studied athletes can be considered a group with a high level of skills. This is proved by their sport results, as well as quite a long training experience for their young age. At the moment all athletes are in the team of Wielkopolska macroregion. The athletes represent various disciplines and are successful at all-Poland competitions. It was assumed that, as opposed to average members of the population, with a stable life style – the studied group should be characterised by high parameters of fat free mass with a relatively lower value of fat mass. Also a thesis was proposed, that an increase in the number of overweight and obese children in the Polish population does not apply to physically active young people. However, the results proved

to be different. Sex differences in body composition of the athletes confirmed antagonistic, typical for the sex, higher share of fat mass in body mass in girls. It was not expected, however, that the level of relative fat content in both analysed groups of female athletes would exceed the upper limit for girls at this age. Admittedly, in comparison to the results of Malina et al. (1991, 2004) in American studies, Brundland et al. (1980) in the Norwegian population, and Krajewska (1997, 1995) in Wrocław studies the analysed female athletes are characterised by a similar level of fat mass. However, taking into consideration the standard for the used body composition analyser, more than 50% of girls had results exceeding its limit. The authors of the above studies unanimously claim that an appropriate fat level in girls at puberty is necessary for ovulation and normal course of the menstrual cycle. However, if we consider that they are people with a high level of physical activity the results should rather be linked with a significant amount of energy provided to the body. What we mean by this is of course a too calorie-rich diet, which is bad nutrition. Chwojnowska et al. (2002) indicate that increased occurrence of overweight and obesity shows that the amount of energy

**Figure 1.** The comparative analysis of fat mass level of girls researched in 2006 and 2008



**Figure 2.** The comparative analysis of fat mass level of boys researched in 2006 and 2008



provided with consumed food exceeds the energy expenditure resulting from both maintaining life functions, growth and regeneration of tissues, individual dynamic action of food and a low level of physical activity. The latter element does not apply to the studied participants. However, the obtained results may indicate that creating appropriate dietary habits was missing from the training process of the studied children. Hawkes (2004) indicates that bad diet in adolescents should be linked to their increased independence in choosing food, increased peer group pressure, inappropriate range of products in school shops as well as aggressive advertising and marketing of shopping centres. As can be seen, these elements exert also its strong influence on young athletes. If we take into consideration that juvenile obesity is an independent risk factor of many diseases and shows a close relation to adult obesity, there should be no doubt that training programmes for children and youths should take into account dietary needs adapted for the age of young athletes (Must, 1986). In prevention the main emphasis should be on teaching appropriate nutrition. Then not only the sports objective would be met, but also health prophylaxis will be carried out. One cannot forget that dietary habits of adults are developed and set in childhood and in adolescence (Mikkilä, 2005). This is somehow an investment in future.

## Conclusions

1. The level of fat content in both analysed groups of female athletes exceeds the upper limit set for girls at this age (16–20%), and girls with excessive fat mass accounted for over 50% of total number of participants. Taking into account that they are people with a high level of physical activity the results of the study are worrying. A higher level of fat mass can be linked to a diet which is too calorie rich and with a period of life of the studied girls.
2. The size of fat component of the studied participants was below the lower limit set for the population at this age. This

is evident in the results obtained in 2006 and 2008. More than 70% of boys doing various sports are characterised by fat mass below the standard.

3. Two years of co-operation between research units of the University School of Physical Education and instructors and coaches of the WSS have received morphological results. In case of girls in 2008 a slight lowering in the level of fat mass was noted, and in the group of boys a smaller number of people with lowered and increased value of relative fat mass was noted; additionally, an increase was noted in the number of athletes with a normal level of this component.

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## HODNOCENÍ TĚLESNÉHO SLOŽENÍ U JEDINCŮ SE STŘEDNĚ TĚŽKOU MENTÁLNÍ RETARDACÍ

### Analysis of body composition in person with mild mental retardation

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#### Abstract

Analysis of the body composition in men with mild mental retardation is not evidenced in Czech Republic. Therefore, the main aims of presented study were to analyze age-related changes in selected body composition parameters and evaluate age-prevalence of obesity in men with mild mental retardation aged 20–49 years. Fifty-seven men with mean age of  $32.66 \pm 8.23$  years participated in this study. Body composition was assessed by bioelectrical impedance analysis with using Tanita BC-418 (50 kHz). According the statistical analysis the non-significant differences were observed in selected body composition parameters. Age-related changes in body composition were similar as in healthy population. Obesity was found in 18.18% of men aged 20–29 years, in 10.53% men aged 30–39 years and 12.50% in the oldest age category. Increasing accumulation of the fat tissue in the trunk was observed according a segmental analysis. The results presented in the study also indicate to necessity carry out similar investigation in women with the same mental disability, as well as in other age categories.

**Keywords:** body fat mass, fat-free mass, obesity, bioelectrical impedance analysis, Tanita BC-418

#### Úvod

Zvýšené ukládání tělesného tuku je primárně spojeno s rozvojem obezity, která je označována za závažné chronické onemocnění podílející se na vzestupu komorbidit a je samostatným rizikovým faktorem vzniku neinfekčních nemocí hromadného výskytu (Hlúbik, 2002). V současné době vychází diagnostika obezity především z určení body mass indexu (BMI), který je pro svou jednoduchost používán v řadě plošných výzkumů. Avšak někteří autoři (Kyle et al., 2004; Riegerová, et al., 2006; Schutz et al., 2002) považují tento hmotnostně-výškový index za nedostačující a doporučují posuzovat prevalenci obezity vzhledem k procentuálnímu zastoupení tělesného tuku (%BFM). Neméně podstatným kritériem je také posouzení charakteru v jeho distribuci, neboť nemoci vyvolané obezitou jsou způsobeny nejen množstvím tuku, ale především jeho distribucí. Androidní obezita představuje podstatně vyšší riziko rozvoje zdravotních problémů, protože je typická zvýšenou akumulací viscerálního (útrobního) tuku, jenž je metabolicky aktivnější, obsahuje velké inzulinorezistentní buňky a má vyšší hustotu adrenergických receptorů než podkožní tuková tkáň (Holeček et al., 2007).

Pro svou vysokou prevalenci je obezita v současnosti často označována za globální epidemii. Jen ve Spojených státech