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Assessment of Body Composition in 7-11-Year-Old Children from Smolyan (Bulgaria) throught Bioelectrical Impedance Analysis (Preliminary data)

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The AIM of this work was to assess the age and gender variability of components of body composition in 7-11-year-old Smolyan children through bioelectrical impedance method. 362 children aged 7 to 11 years, of which 177 girls and 185 boys from Smolyan were the object of this study that measured transversally in the period January-May 2012 in four schools in the town of Smolyan. Children are divided into five age groups, and their average age was respectively 7.5, 8.5- to 11.5 years. The results of this study show that in the in body composition of the girls during the investigation period prevails absolute and relative quantity fats, as boys are characterized with bigger quantity free- fat mass quantity, i.e. with better skeletal - muscular development. In the two sexes the age changes at components of body composition were in relation with growth of levels of fat mass (FM) and free fat mass (FFM). The used bioelectrical impedance analysis is high-informational and reliable at population researches of assessment body composition and respectively for monitoring of deviations from normally physical development and body nurtitional status.

Key words: body composition, children, bioelectrical impedance analysis.

Introduction

It is known that the components of body composition are important and informative health indicators were used for monitoring of physical development and to diagnose deviations of normal nutritional status. For specialists one of the most important and disscussed problems was a question of the methods for accurate assessment of the quantities of body composition's components that can be used for diagnostic of deviations from normal physical development and particularly from normal nutritional status of the human body. Today in practice for assessment of body composition were used different methods, but one of the most advanced methods for population studies is the method of bioelectrical impedance analisys - BIA [1, 3, 5, 6, 7], became popular over the last decade. It is an objective, relatively accurate, noninvasive and easily applicable in practice evaluation method and fractionation of body composition.

The importance and relevance of studies related to body composition assessment in childhood for the monitoring of deviations in normal physical development and nutritional status defined the AIM of this work namely to assess the age and gender variability of components of body composition in 7-11-year-old Smolyan children through bioelectrical impedance method.

Material and methods

This work presents preliminary data from a study of the physical development of 362 children from Smolyan, aged 7 to 11 years, of which 177 girls and 185 boys. The study was performed transversally in the period January-May 2012 in four schools in the town of Smolyan. Children are divided into five age groups. For example, in the group of 8.5- year-olds included children aged 8.0 to 8.99 years. For convenience in analyzing the results of the age groups are given in integers. By Martin-Saler's method [4] of each person directly were measured two basic anthropometric indicators - height and weight. For assessment of body composition was used a two-component model of Behnke [2]. The relative values of body fat (% BF) were measured using bioelectrical impedance analysis (BIA) by body composition analyzer Tanita BC 453, an accuracy of 0.1%. Two main components of the body composition - fat mass (FM, kg) and and fat-free mass (FFM, kg) and the ratio between this two components (FM/FFM, kg) were calculated in addition. The collected data were processed using the statistical software package STATISTICA 6.0, by descriptive analysis. The differences between age and gender group were assessed by Student's t-test at significance level p= 0.05.

Results and discussion

The average values of the investigated indices in children of both sexes are shown in fig. 1-6.

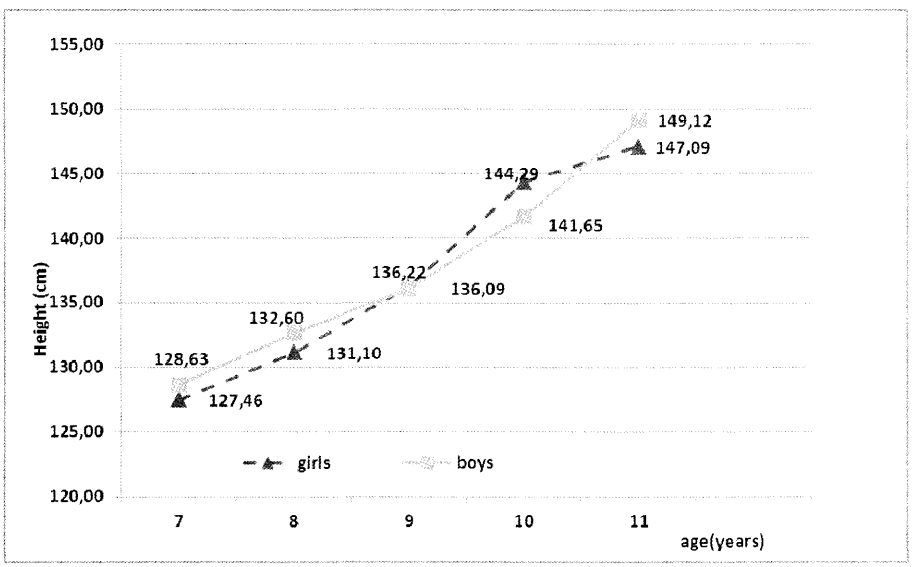

Fig. 1. Age and gender changes in the **height**

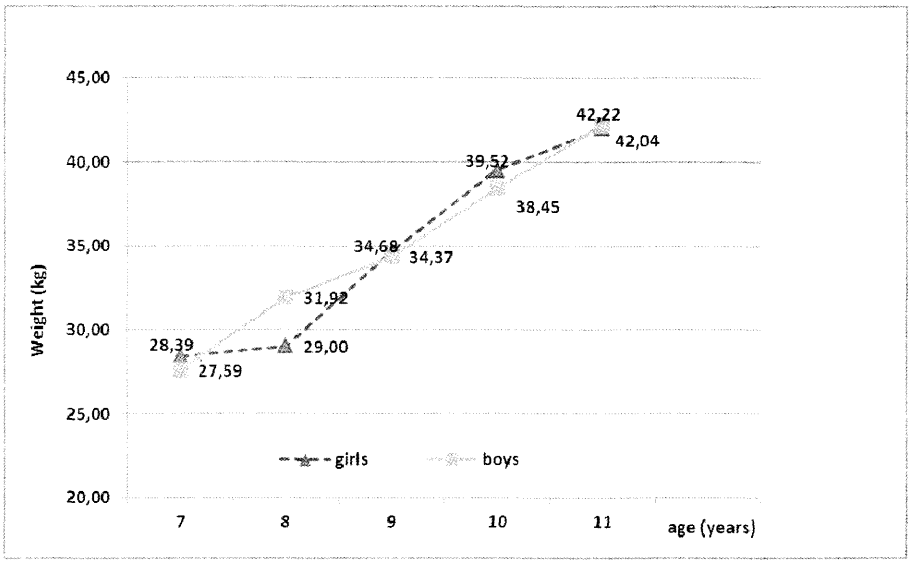

Fig. 2. Age and gender changes in the **weight**

Average **height** (Fig.1) of the contemporary generation of children in Smolyan during stidied period grows normally and continuously. The differences between separate age are statistically significant throughout the period ($p<0.05$). Differences between both sexes in this period are in boys` advantage, with exception of the 10th year of their life.

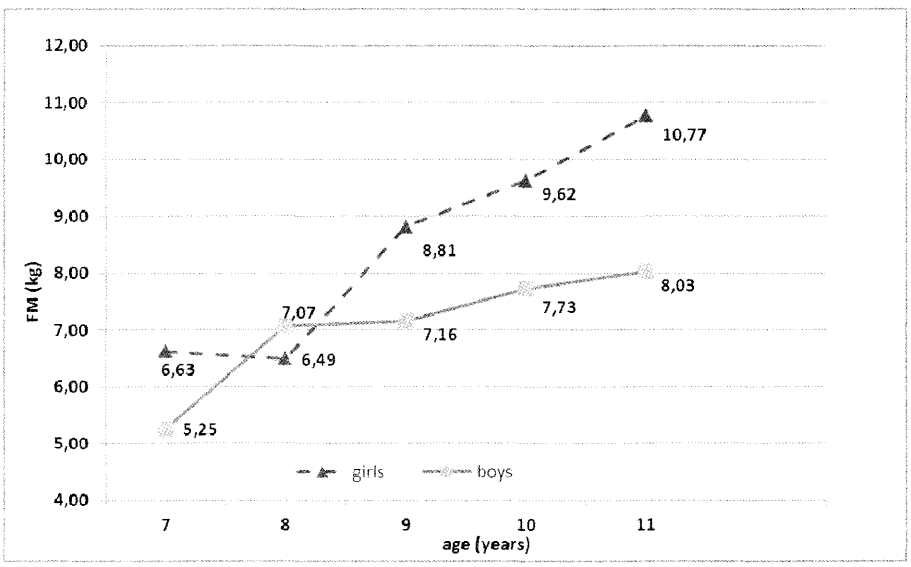

Fig. 3. Age and gender changes in **FM (kg)**

Similar results are show for **weight** (Fig.2). Significant increasing in the mean values observed in girls between 8-9th year (5.67 kg) and 9-10 years (4.84 kg) probably related to prepubertal growth acceleration. At boys statistically significant accumulation of body mass (4.2 кg) is seen between 7-8th and 9-10th year. The differences between sexes in body weight are non-significant and they are in girls` advantage. An exception is the 8th year which is probably connected with the simple.

One of the components of body composition with medical and biological importance is the relative part of the body fat. In our investigation for asses of % BF we used measuring of the bioelectrical impedance analysis. On the base of the relative values of BF are calculated absolute values of the body fat in kg i.e. fat mass (FM).

The **fat mass** (Fig.3) at the girls through the seen start school period grows general and middle with 4.14 kg, but at the boys- with 2.78 kg. Maximum accumulation of body fats in girls is seen between 8-9th year (2.32 кg), but in boys-between 7-8ht year (1.81 кg). The differences between sexes show predominating absolute part of body mass at girls, with exception of 8th year as reliable are differences only between 9th years old children ($p<0.05$).

Average values of other basic components of body composition, i.e. **fat-free mass (FFM)** (Fig.4) at boys are grown generally with 11.3 kg through the whole period. Maximum year accumulation of FFM at them is seen between 8-9th year (3.85 кg), but statistically significant interage differences in whole the period, with exception of 10-11th year. At girls accumulation of FFM is done with slow temps as general increasing for this period is 9.4 kg.

The data from our study for the two body components - fat mass and fat-free mass, are similar to the results for Sofia children [7, 8], independently of different method for assessment of body fat % - Slaughter equations used from Mitova [7] and BIA (Tanita) used in present study.

Through the observed age period changes in **boys body composition** (Fig. 5) mainly due to accumulation of active body mass, and very small extent of fat mass

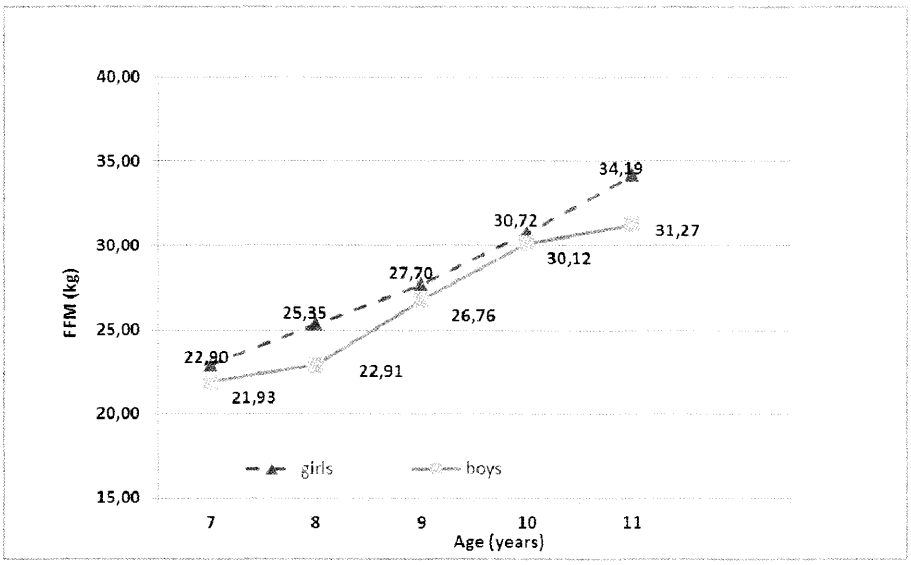

Fig. 4. Age and gender changes in **FFM (kg)**

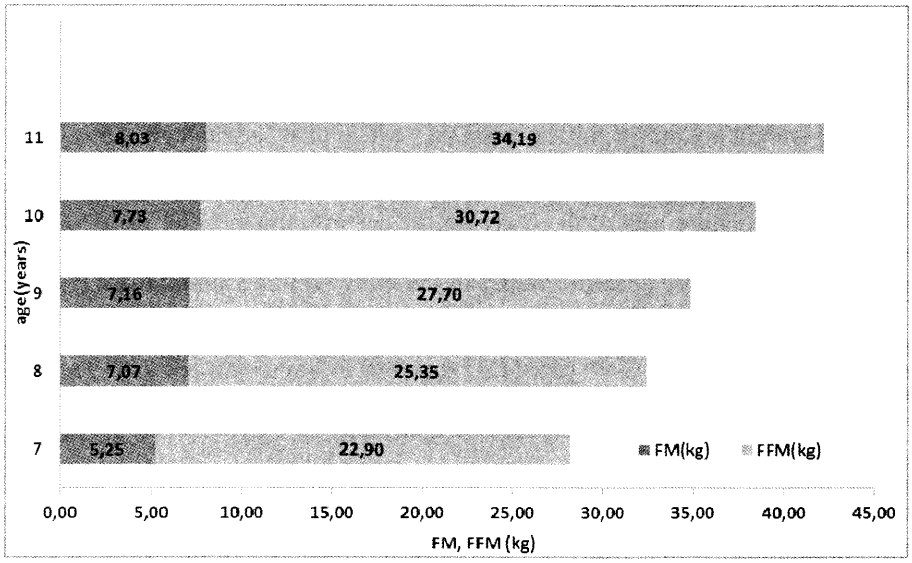

Fig. 5. Age changes in body composition **in boys**

(FM) as well. At girls, age changes in body composition (Fig.6) due to increase in lean, and fat component as well, especially after 8th year.

Another informative indicator is the ratio showing the distribution of body fat mass for a kilogram fat-free mass (BF/FFM, kg). The results of this ration showed that during the investigated period, girls put on bigger absolute amount of body fat mass for a kilogram fat–free mass than boys, with an exception of the 8th year. In intersexual plan

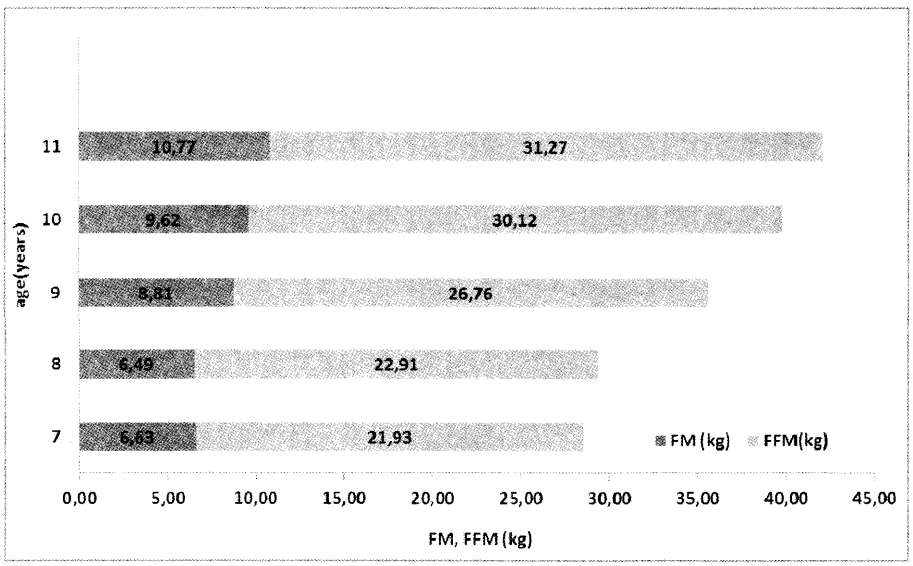

Fig. 6. Age changes in body composition **in girls**

the biggest differences are during the 11th year, when girls put on 1.1 kg amount of fat mass in a kilogram fat free mass (FFM) more than boys do.

In conclusion used bioelectrical impedance analysis is high-informational and reliable for population researches and assesment of body composition and respectively for monitoring of deviations from normally physical development and body nurtitional status.

References

1. Andreenko, E., M. Nikolova. Bioelectrical impedance analysis assessment of body composition of children and adolescents from Plovdiv (Bulgaria). – Glasnik, ADS, **46,** 2011, 59-65.
2. Behnke A. R. Anthropometric evaluation of body composition trough life. – Ann. N.Y. Acad. Sci., **110,** 1963, 450-464.
3. Khomyakova, I., E. Godina, L. Zadoroghnaya, A. Tretyak, E. Dorogova. Body composition in children and its Relationship with Sexual Maturation Level. – Acta Morph. et anthrop., **15**, 2010, 194-198.
4. Martin, R., K. Saller. Lehrbuch der Anthropologie. – Stuttgart, Custav Fisher Verlag, 1, 1957, 661.
5. Tineshev, S. Estimating body composition in 18-year-old girls and boys through the method of bioelectrical impedance analysis. – Glasnik, ADS, **46**, 2011, 67-72.
6. Topuzov, I., Z. Mitova, E. Kavdanski, N. Petrova, D. Dencheva (2002): Assessment of the obesity by means of the body and fat mass. - *Kineziterapy,* Sofia, **2**, 2002, 18-24.
7. Митова, З. Антропологична характеристика на физическото развитие, телесния състав и телесната охраненост при 9-15 годишни деца и подрастващи от София. – Автореф. на дис., София, 2009, 1-32.
8. Начева, Ан., Я. Жечева, Ив. Янкова, Зл. Филчева, З. Митова и Й. Йорданов Физическо развитие на деца и подрастващи в България на границата между XX и XXI век / Под ред. на Й. Йорданов/. – Изд. "Марин Дринов", 2012, София.