Institute of Experimental Morphology, Pathology and Anthropology with Museum
Bulgarian Anatomical Society

Acta morphologica et anthropologica, 17
Sofia • 2011

Relation Between Body Composition and Some Social Factors and Habits in Children and Adolescents

M. Nikolova[*], *D. Boyadjiev*[**]

[*] *Department Human Anatomy and Physiology, University of Plovdiv*
[**] *Department Applied Mathematics and Modelling, University of Plovdiv*

The purpose of this study is to assess how essential the individual factors and social habits and their combination are for body composition of a body. It was made a transversal analysis of 1155 girls and 1114 boys aged 7 to 17 years in 2008/2009 by the anthropometric and bioimpedance-metric methods. The estimation of body type nutritional status was made by the discriminatory values of BMI for underweight and normal status, overweight and obesity. The survey showed that the complex issue of socio-economic factors have a determinative role regarding the main body components. The socio-economic status can be used as a starting point for predicting the body nutritional status of adolescents.

Key words: Body composition, anthropometry, bioelectrical impedance analysis, socioeconomic factors, children and adolescents.

Introduction

Studying the influence of the socioeconomic factors on growth and development of children and adolescents has a long history. In recent years, attention is drawn to body composition of growing organisms and the assessment of body components that make up the weight. Experts' attention is focused on the information which BMI gives to assess the type of body nutritional status [1, 4]. To some extent, the individual differences during the intense growth and development also depend on the socio-economic living conditions [2, 5, 8]. The socioeconomic factors traditionally are related to parents' education and occupational status, residential living conditions, income, living standards, etc.

The purpose of this study is to assess how essential the individual factors and social habits and their combination are for body composition of a body. If it is possible to predict the level of body nutritional status on the basis of socio-economic factors and habits.

Materials and Methods

We tested anthropometrically and by the method of bio-impedance analysis 2269 children and adolescents from Plovdiv /1114 boys and 1155 girls/, aged 7 to 17 years, in 2008/2009. The anthropometric program includes 31 indicators, directly measured, – height weight, 5 body diameters, 11 circumferential features of the torso and limbs, 9 skin folds and 4 bone diameters. Through the means of Matiegka's method [6] we estimated the fat, muscle and bone components of body composition, and through Skerlj's method – the subcutaneous fat mass [7, 8]. We estimated the absolute and relative values of fat and fat-free masses and active cell mass with a bioelectrical impedance analyst ABC – 01 "Medas", equipped with special software [3]. On the basis of anthropometric features we estimated BMI and its two components – index of active body mass /IABM/ and index fat mass /IFM/. The estimation of body type nutritional status was made by the discriminatory values of BMI for underweight and normal status, overweight and obesity. Through inquiry method we collected information on the following determinative socio-economic factors and habits: father's and mother's educational and professional qualifications, both parents' job, number of family members and household standard of living, floorage and average income per family member; sports, alcohol drinking and smoking.

The data on body components are standardized according to the age and gender. The significance of the relation between body components and social factors was assessed using factor analysis with Student's criterion /in 2 levels of the factor/ and Fisher's /in more than 2 levels of the factor/. We applied linear discriminatory analysis for modelling and predicting the levels of body nutritional status by the social factors and habits.

Results and Discussion

Table 1 presents the results of the analysis of the influence of socio-economic stratification and habits on components of body composition in the tested children and adolescents. In both sexes, the dependencies of most body components on father's educational level and number of family members are significant. There were also gender differences. Girls' body composition depends on the family living standard as well, and in boys – on the type of family. For both sexes, sports activity is in a significant dependence on muscle tissue, while alcohol drinking on fat mass. Only in girls, fat mass and subcutaneous fat mass showed a significant relation to smoking. Differences can also be seen in the different levels of a factor. Sons and daughters of fathers with secondary school education have values of fat component and BMI above average. Father's educational levels are also a differentiating factor regarding muscle and bone tissue, but only in girls, while the type of family is a differentiating factor for BMI and subcutaneous fat in boys.

The next task was to examine the possibility of predicting the level of body nutritional status /according to the discriminatory levels of BMI/, basing on socioeconomic factors and habits. For this purpose linear discriminatory analysis was applied. In the model which we used there were four groups of the classification variable: underweight, normal status, overweight and obesity. Using the version of behavioural discriminatory analysis of all 11 socio-economic factors, we identified 8 predictors in girls and 7 in boys, which can be seen on Table 2. With their help we predicted to which of the groups of body nutritional status each child belongs. Results for girls are given in Fig.1. They show that the model works best for obese girls /50% correctly predicted by the model/,

Table 1

Body composition components with statistically significant differences in the different levels of social factors and habits												
Body components		*Social factors and habits (where **p≤0.1** according to T/F criterion)*										
		Father's education	Mother's education	Father's profession	Mother's employment status	Type of family	Number of family members	Average income	Lifestyle	Sports activity	Alcohol	Smoking
Fat mass	♀ ♂	0.066 0.014				– 0.007	0.016 0.004				0.023 0.025	0.006 –
Fat-free mass	♂+♀								0.096 –	0.006 –	– 0.072	
% Fat mass	♀ ♂	0.041 0.015				– 0.001	0.029 0.010					
Active cell mass	♂+♀								0.009 –	0.000 –		
Subcutaneous fat mass	♀+♂					– 0.078	0.045 0.024				0.000 –	0.000 –
Muscle tissue	♀+♂	0.036 –			– 0.089		0.022 –			0.007 0.072		
Bone tissue	♀+♂	0.092 –		– 0.098		0.065 –	0.081 –				0.002 –	
Body Mass Index	♀ ♂	0.059 0.016				– 0.068	0.007 0.025		0.073 –		0.017 0.032	
Fat-free mass index	♀ ♂	0.002 0.019	0.003 –	– 0.083		0.065 0.095	0.017 –	0.015 –			0.000 0.000	0.003 0.023
Fat Mass Index	♀+♂	0.024 0.005	0.060 –			– 0.002	0.015 0.007	0.067 –	0.058 –		0.000 –	

Table 2

Discriminative socio-economical predictors in girls and boys	
girls	**boys**
Factors included in the model	
Mother's profession	Father's education
Father's profession	Floorage
Average income	Average income
Mother's education	Family members number
Lifestyle	Mother's education
Father's employment status	Family type
Floorage	Mother's profession
Family members number	
Factors outside the model	
Father's education	Father's profession
Mother's employment status	Father's employment status
Family type	Mother's employment status
	Lifestyle

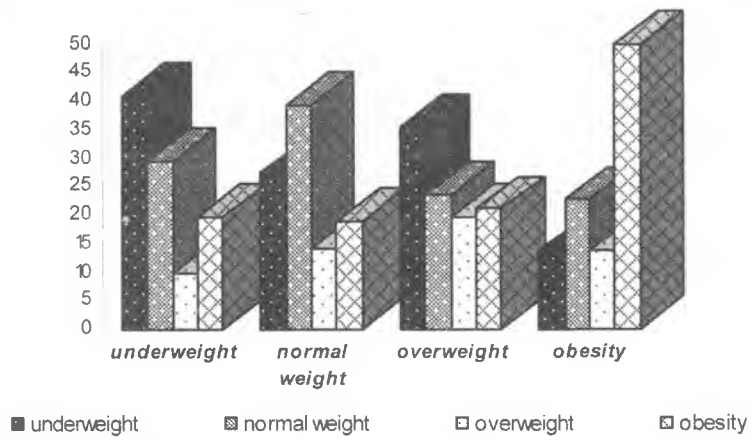


Fig. 1. Percentage of posteriori classification by social factors – girls

followed by those of underweight /41%/ and the lowest is the prediction for girls with overweight – probably because they are an intermediate group. The total percentage of correctly classified by the model girls is 36.8%.

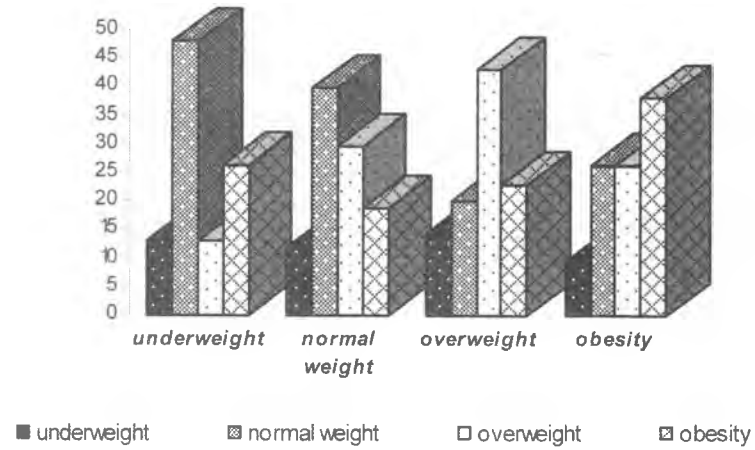
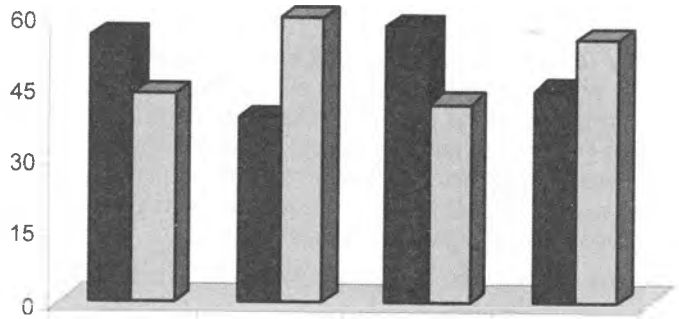


Fig. 2. Percentage of posteriori classification by social factors – boys

Table 3

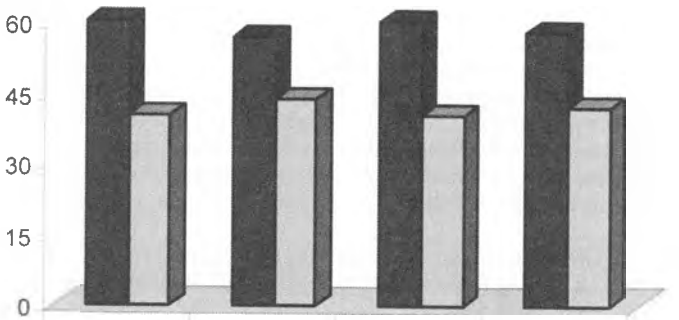
Discriminative socio-economical and behavioral predictors in girls and boys	
girls	boys
Factors included in the model	
Alcohol	Sports activity
Lifestyle	Father's employment status
Father's profession	Mother's education
Floorage	Father's education
Mother's employment status	Family members number
Average income	Alcohol
Family members number	Mother's employment status
	Lifestyle
	Smoking
	Family type
Factors outside the model	
Sports activity	Father's profession
Smoking	Mother's profession
Father's education	Floorage
Mother's education	Average income
Mother's profession	
Father's employment status	
Family type	

For boys (Fig.2) the model gives the best prediction for those who are overweight (42.9%) and the lowest – the boys with underweight (13%). The total percentage correctly classified by the model for boys was 38.4%.



	underweight	normal weight	overweight	obesity
correct	56	38,8	58,1	44,6
incorrect	44	61,2	41,9	55,4

Fig. 3. Percentage of posteriori classification by social factors and habits – girls



	underweight	normal weight	overweight	obesity
correct	60	56,5	60	57,9
incorrect	40	43,5	40	42,1

Fig. 4. Percentage of posteriori classification by social factors and habits – boys

The next step was the habits of children to be added to the model. In this case, adolescents over 11 years were included and the last two groups of the classification variable were united. The discriminatory variables in the new models are shown on Table. 3. The predicted body nutritional status in girls, as shown in fig. 3, is best for overweight (58.1%) and underweight (56%). In boys (fig. 4), the model gives 50% correct classification for all three levels of body nutritional status. The total correct classification rate after including the habits increases in both sexes – girls from 36.8% to 44.6%, and for boys from 38.4% to 57.9%.

Conclusion

The survey showed that the complex issue of socio-economic factors have a determinative role regarding the main body components. The socio-economic status can be used as a starting point for predicting the body nutritional status of adolescents. It appeared to be a good predictor for predicting the occurrence of certain bad habits and upcoming changes in body status. It is a matter of big interest to what extent the statistical approach is also applicable to the creation of a priori prognoses for the age changes in the body components of a growing organism.

Acknowledgements. This work is supported by grant No ВУ-Л – 313/2007 from the Bulgarian National Science Fund.

References

1. Година, Е. З., Задорожная, Л. В., Пурунджан, А. Л., Третьяк, А. В., Хомякова, И. А. Некоторые особенности состава тела у детей и методические проблемы его изучения. «Вопросы антропологии», 2007, 93: 18-39
2. Година, Е. З., Задорожная, Л. В. Влияние некоторых факторов окружающей среды на формирование особенностей соматического развития детей и подростков. – Вопр. Антропол.,1990, вып. 84, с.18-30
3. Николаев, Д. В. Биоимпедансный анализатор АВС-01 „Медасс“. Руководство пользователя, Москва, 2001. 24 с.
4. Пурунджан А. Л., Година, Е. З., , Хомякова, И. А., Задорожная, Л. В., Савостьянова Е. Б., Бердникова М.С., Третьяк, А. В. Возрастные изменения состава тела у московских детей и подростков. – В: Сборник трудов ученых РГУФК, М., 2006, 8-15.
5. Godina, E., Khomyakova, I., Purundzhan, A., Zadorozhnaya, L. Some differences in body composition in Moscow adolescent children according to the level of their physical activity: comparison of anthropometric and bioelectrical impedance methods of assessment. // Human Body Composition. Eds. S.P.Singh, Rajan Gaur. Kamla-Raj Enterprises, Delhi: India, 2007, 63-74.
6. Matiegka, J. The testing of physical efficiency. – Am. J. Phys. Anthrop., 1921, 223-30.
7. Smirnova, N. S, Shagurina,T. P. Methods of Anthropometric Investigations, pp.16-22. In: Methods of Morphophysiological Investigations in Anthropology. Moscow State Univ. Publishers, 1981.
8. Parizkova, J. Body Fat and Physical Fitness.,1977, Nijhoff: The Hague.