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Trends in Body Mass Index in School-age children in Central-Europe (Transdanubia, Hungary)

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ABSTRACT

Based on the results of the growth studies performed at two locations in Transdanubia (Europe, Hungary), in Körmend and Kaposvár, a positive secular trend was observed in several parameters including the Body Mass Index (BMI). BMI over 11 years of age exceeded the standard values in Hungary. These changes around puberty are warning signs of the development of obesity in adulthood. Adult obesity is an important risk factor for cardiovascular diseases.

Key words: *Body Mass Index, Hungarian children, Körmend, Kaposvár*

INTRODUCTION

Body mass index (BMI, kg/m^2) (Ihász 2013) was introduced into the human biology practice for the statistical evaluation of nutritional status according to the suggestions of Keys and coworkers (Eiben 2003, Heyward -Wagner 2004 , Eiben et al. 2007, Claessens et al. 2008). As evidenced by experience, the method is not appropriate for the estimation of body composition (Eiben 2003), as it makes no distinction based on the measures of individual body components, width or circumference of body parts. In adults, BMI data can be evaluated according to WHO recommendations (WHO 1998). In the case of Hungarian children the reference for data comparison is the calculated BMI values obtained in the II. Hungarian National Growth Study (Bodzsár–Zsákai 2012), as well as the limit values, determined by the BMI percentiles, which are reflecting the nutritional status (Zsákai et al. 2007, 2008). Based on the data collected during the decades of the Körmend Growth Study the comparative BMI values for West-Hungarian children have already been reported by the authors (Tóth–

Suskovics 2011a). The many questions generated during the data analysis prompted further investigations and the evaluation of the related data of the South Transdanubia Kaposvár Growth Study (Suskovics et al., 2013a, b).

MATERIALS AND METHODS

Our study took place at two cities in Transdanubia: Körmend and Kaposvár. The Körmend Growth Study (KNV), which is associated with the name of Dr. Eiben, who launched it in 1958 and which was repeated every 10 years since, demonstrated for the first time in Hungary certain aspects of the phenomenon known as the secular trend. The secular trend is a global phenomenon which is manifested in long-term, systematic changes in a wide range of anthropological traits occurring in successive generations of people living in a particular geographical region. This series of experiments defined those changes in the growth and maturation of children which resulted from the changing environment and genetic background (Eiben 1988, 2003, Eiben–Tóth 2005). Our processed data were based on six studies reflecting results obtained in healthy children of 3-18 year old. The experimental sample was representative in all cases, about 72-95%.

The Kaposvár Growth Study was launched in 1928 by Dr. György Véli (Véli 1936). This series of experiments was the first to demonstrate the phenomenon called acceleration in Hungary (Véli 1967). Over the past more than eighty years, there were several studies executed in Kaposvár (for more details see: Véli 1948, 1968, Bodzsár–Véli 1980, Suskovics 1997, 2003, 2004, Suskovics–Eiben 2002, Suskovics et al., 2013a). In this work we are reporting not only the data of prior studies, but the related results of our 2012 cross-sectional study (Suskovics et al., 2013b). In the autumn of 2012 35% of the 6-15 year-old children (n = 3000) were included in the research. In the present study we are reporting the test results of 459, 10-14-year-old children (201 boys and 258 girls) in connection with the previous experiments. The tests were performed according to the technique developed by Martin, taking into account the related recommendations of IBP / HA (Martin–Saller 1957, Tanner et al., 1969). The statistical calculations were performed using SPSS and Excel software packages.

RESULTS

Based on the analysis of the data series of the Körmend Growth Study, which was covering six decades, we found that a positive secular growth trend is still present in body height and weight in western Hungary.

We considered it as an adverse change that actual weight gain was more pronounced than it could have been expected in proportion of the increase in height (Tóth et al., 2009a, b). At the same time we also observed a change in the growth pattern of children (Tóth et al. 2009b, 2012). Another adverse change (especially for boys) was the significant increase in hip and navel skinfold values which was the consequence of unfavorable changes in eating and exercise-activity habits (Tóth 2010, Tóth–Suskovics 2010, Tóth–Suskovics 2011b, Suskovics–Tóth 2011). In connection with these changes we observed a strong increase in BMI values for boys from the age of 9. There was a more significant increase from the age of 13, which corresponds to high hip and abdominal fat deposits, characteristic for this age and for the new millennium, which predict adult abdominal obesity as a risk factor. For girls, the same trend was seen, although in a less pronounced degree.

By comparing the average values of the 2008 Körmend survey to the results of the II. Hungarian National Growth Study (Figure 1) it could be seen that the unfavorable – larger than the national average – BMI values are typical from age 11, but the values are within the normal nutritional range.

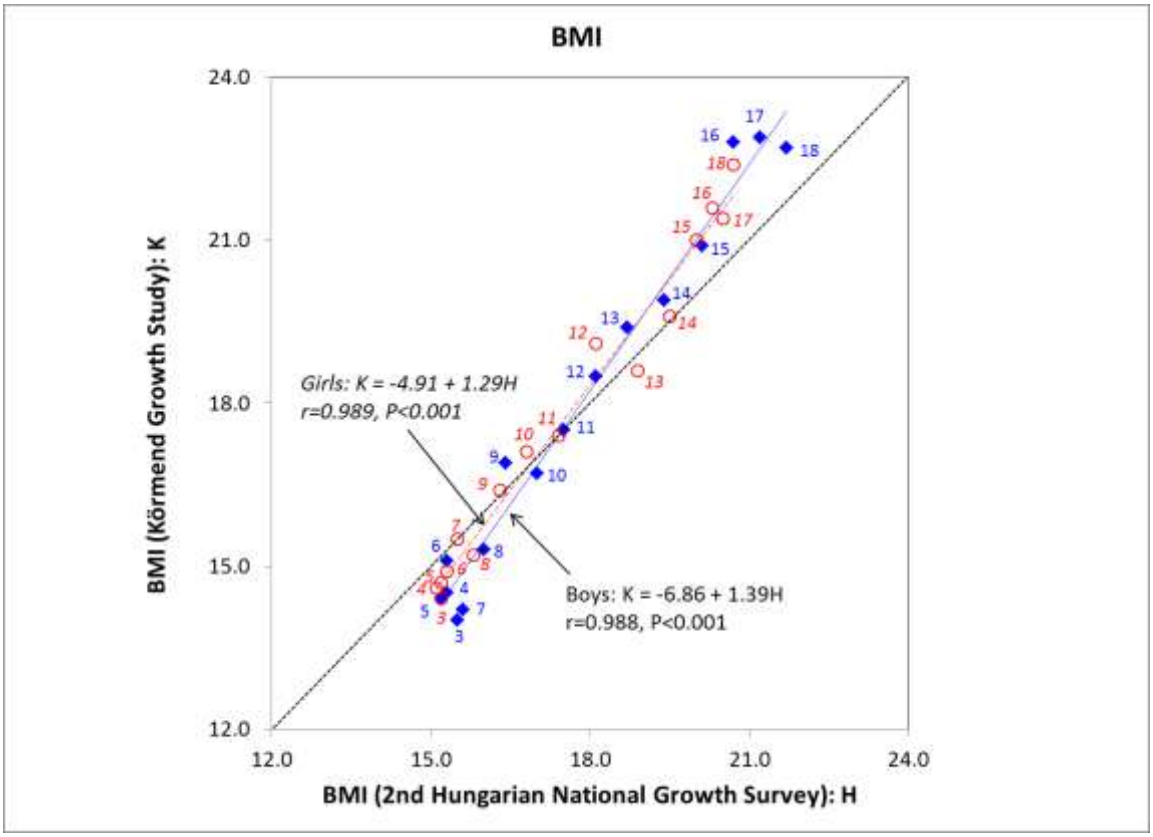

Figure 1. BMI-values of 3-18 year old children in Körmend (2008) in correlation with the results of the II. Hungarian National Growth Study

Based on the figure we can conclude that those changes (fat accumulation) which lead to higher than the national average body mass index start around at age 11, most possibly it is connected to puberty, and progress faster and faster with the age of the children.

Based on this result we decided to analyze the BMI values of 10 to 14 year old children measured at the other test site of Transdanubia, in Kaposvár by focusing on this trend. It is clearly seen on the regression lines on Figure 2. and 3. that the positive secular trend is valid even for the indexes at all age groups. As the age of the children is progressing the difference is more and more significant, reflecting the process of fat accumulation.

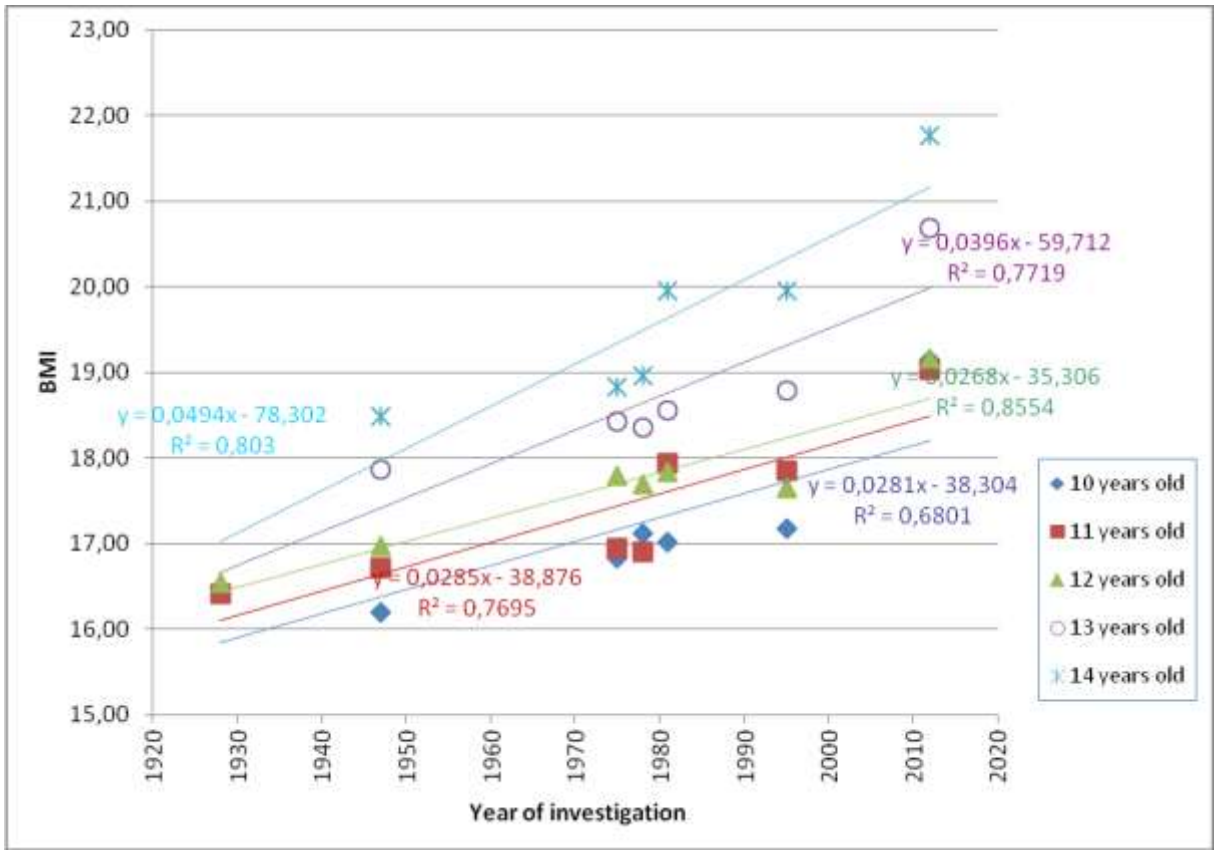

Figure 2. Secular trend in BMI values of 10-14 year old boys in Kaposvár

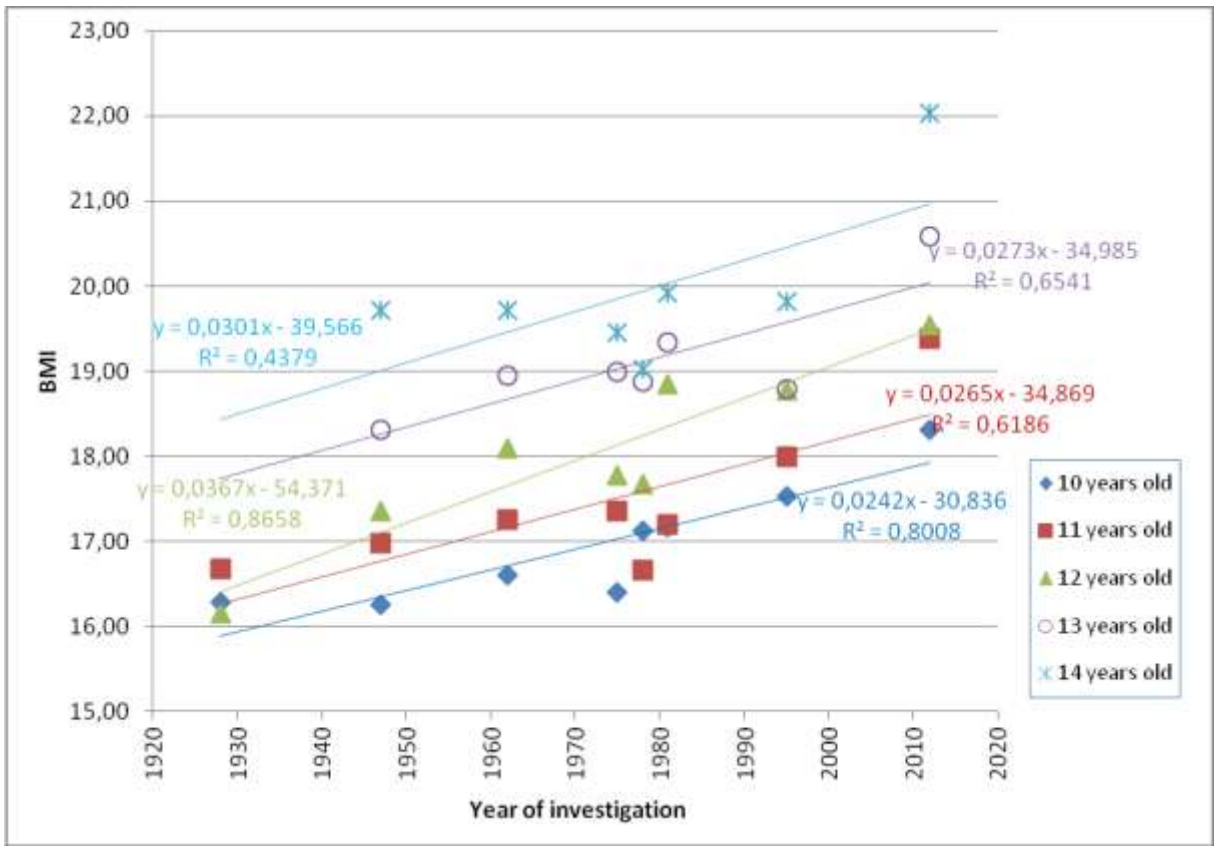

Figure 3. Secular trend in BMI values of 10-14 year old girls in Kaposvár

DISCUSSION

Analysis of the data obtained in Körmend and Kaposvár showed that body mass gain (accumulation of body fat) associated with puberty changes was larger for children in Transdanubia than that of the national average, as it was indicated by the higher values of the body mass index. A positive secular trend was observed for BMI at both test locations. However, this could not be considered as a favorable development, because it is caused most possibly by an inactive lifestyle and an unhealthy diet. This observation predicts an increase in adult obesity in the near future. This estimation is supported by the data showing the large increase in fat accumulation in the abdominal regions. Abdominal fat is a good indicator of adult cardiovascular risk as well (Pintér 2013).

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