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BODY MASS INDEX AND LEAN BODY MASS INDEX

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Abstract: *Body mass index (BMI: height/weight^2) and lean body mass index (LBMI: height^2/weight), as two measures of obesity, were studied in a national representative sample of 18-years-old Hungarian conscripts (n=8,002) surveyed in 1998. Comparison was made with the sample of conscripts at the same age surveyed in 1973 (n=9,495) and with male students of the Technical University of Budapest surveyed between 1976-1990 (n=9,805). For the socioeconomic status of the samples the urbanisation and the parental education were taken into consideration. The values of BMI and LBMI showed that the proportion of the body fat was smaller in the conscripts than in the students. However, the increase of body fat was higher in the conscripts, than in the university students during the last decades. The conscripts and students from Budapest had more body fat, than their counterparts from smaller settlements. At the same time the conscripts and students with higher educated parents had less body fat than the conscripts and students with elementary or secondary educated parents. In spite of the fact that the BMI does not have a normal distribution, contrary to the LBMI, there were not too many differences between them, although the LBMI seemed a bit more sensible predictor of obesity than BMI.*

Keywords: *BMI; LBMI; 18-years-old conscripts; University students; Socioeconomic status.*

Introduction

According to the widely held perception in the public, obesity is simply a result of overindulgence in highly palatable foods, or lack of physical activity. Nowadays, it is clear that obesity is a consequence of an energy imbalance where energy intake exceeds energy expenditure over a considerable period (WHO TRS 894, 2000).

Obesity, as a disease in its own right belongs to the group of the so called noncommunicable diseases (NCD). However, obesity is one of the key risk factors for other NCDs, such as hypertension, cardiovascular diseases, stroke, diabetes and several kinds of cancer. The NCDs cause the major part of mortality and morbidity of the adulthood: at least 40 % of all deaths in developing countries and 75 % in industrialised countries, where cardiovascular diseases (CVDs) are the first cause of morbidity (WHO Feat. 1996). At the same time, obesity-related symptoms like psychosocial problems, abnormal glucose metabolism, hepatic-gastrointestinal disturbances, sleep apnoe and orthopaedic complications appear already in children and adolescents (WHO TRS 894, 2000).

The health status of the Hungarian population – especially of males – is one of the worst all over in Europe. In Hungary the major part of mortality (more than 50 per cent) is caused by cardiovascular and cerebrovascular diseases (Statisztikai adatok, 1999) which appear every year in younger and younger age-groups. Therefore, from the point of

view of the prevention, it is necessary to conduct the health surveys – especially for males – at least at early adult age.

The prevalence of obesity is one of the best indicators to show how endangered the health status of a population is (WHO PR 1997).

Several methods are at disposal for assessing obesity, but for epidemiological survey the body mass index (BMI: height/weight^2) has been applied to adults for several decades, inspite of the criticisms by Ross et al. (1988, 1996), Wellen et al. (1996) and others, about the relationship of the BMI and body fat per cent. Recently, another measure of obesity, the lean body mass index (LBMI: height^2/weight) has been introduced by Nevill and Holder (1995). Contrary to the BMI the LBMI is symmetric and normally distributed and what is more, the association between LBMI and height is stronger than between body weight and height. Therefore, LBMI should be a better predicator of the proportion of body fat and obesity than BMI.

The goals of this study are to compare two measures of body composition, the BMI and LBMI in our samples of conscripts and university students, and to analyse the effect of some socieconomic status (the degree of urbanisation and educational status of the parents) to the body composition of these young Hungarian males.

Material and Method

National representative samples of young males in Hungary can be taken only on the occasion of the military conscription, because it is obligatory for all males at the age of 18. The first representative sample of Hungarian conscripts was taken by Nemeskéri et al. (1983) in 1973, and our sampling was based on their methods and the data were collected from conscripts of the same age of the same populations.

Our sample was taken from the cohors of the 18-year-old males born in 1980 from six counties: Borsod-Abaúj-Zemplén (B), Hajdú-Bihar (HB), Pest (P), Bács-Kiskun (Bkk), Veszprém (V) and Somogy (S); as well as from four large towns: Miskolc, Debrecen, Szeged and Pécs (FLT) and from Budapest (Bp), the capital of the country, who were conscripted and surveyed in 1998. The counties represented industrially different regions of the country. The sample consists of 8002 conscripts and not only anthropometric, but psychologic, medical and demographic data were also collected (Gyenis and Joubert 2002, Joubert and Gyenis 2002). Comparison was made with data of the conscripts surveyed by Nemeskéri et al. (1983) in 1973 (n=9495) and with the 20-year-old male university students from fifteen consecutive classes of the Technical University of Budapest investigated by Gyenis (1997) between 1976-1990 (n=9805).

Among the large number of socioeconomic factors collected in the samples, in this paper only the degree of urbanisation and parental education were taken into consideration.

As known, university studenst are not representative of the whole population. In our sample, the majority of the university students (more than 50 per cent) were born and lived in Budapest, where only about 20 per cent of the whole Hungarian population lives. Therefore their sample was divided into only two parts according to the place of birth: born in Budapest and born elsewhere than Budapest.

The degree of urbanisation was expressed by the population size in the place of residence of the conscripts: 1. Budapest (Bp), the largest city of the country, 2. large

towns with population over 100,000 (FLT), 3. small towns and rural settlements (villages) in the six counties (B, HB, P, Bkk, S, V).

The educational status of the parents of the conscripts and university students were classified according to the completed school years: 1–8=elementary, 9–12=secondary, 13–18 university (or college).

Results and Discussion

The value of BMI increased both in the samples of the university students and conscripts during the investigated period, which suggest the increase of the proportion of body fat in both samples. Since, there is an inverse relationship between the BMI and LBMI, therefore the values of LBMI decreased in the university students during the period, which also showed the change of body composition, the increase of the body fat. The values of BMI are lower in the conscripts, than in the university students, but in the conscripts they increased with a larger proportion than in the students. The value of LBMI is higher in the conscripts than in the students, which also means that the conscripts – who represent the average population of that age - had less body fat than the students (Figure 1).

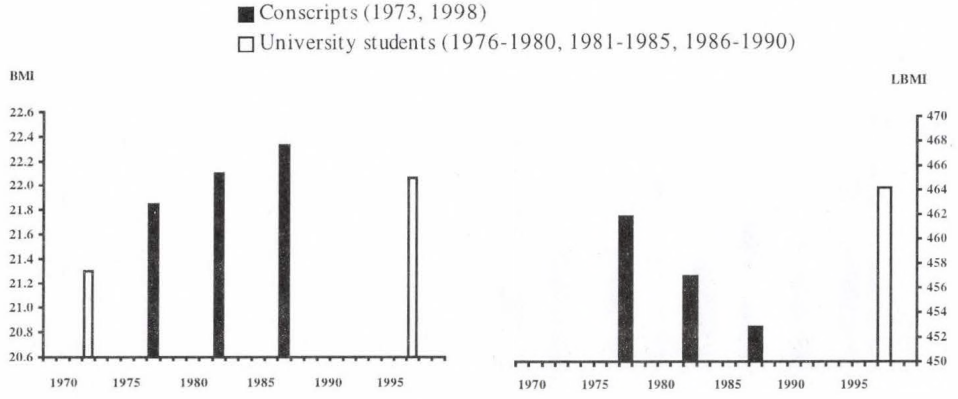

Figure 1: BMI and LBMI of conscripts and male university students between 1973–1998.

In the university students the BMI and LBMI show differences according to the place of birth and the educational status of the parents. Those students, who were born elsewhere than in Budapest and those, who have parents on low educational level, have less body fat, than the students born in Budapest and the students, whose parents are on higher educational level. However, at the end of the investigated period the differences are very small (Figure 2).

The differences of the BMI and LBMI in the conscripts according to the degree of urbanisation and the educational status of the parents show the same tendency as it can be seen in the university students. The values of the BMI and LBMI refer to higher body fat contents in the conscripts of Budapest (Bp), than in the conscripts of the towns (FLT) or

smaller settlements of the six counties (B, HB, P, Bkk, S, V) and the differences were significant (Figure 3).

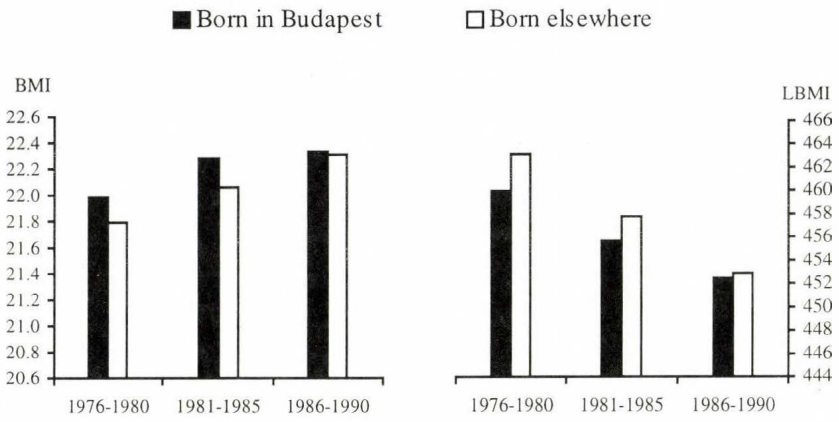

Figure 2: BMI and LBMI of the university students acording to the place of birth.

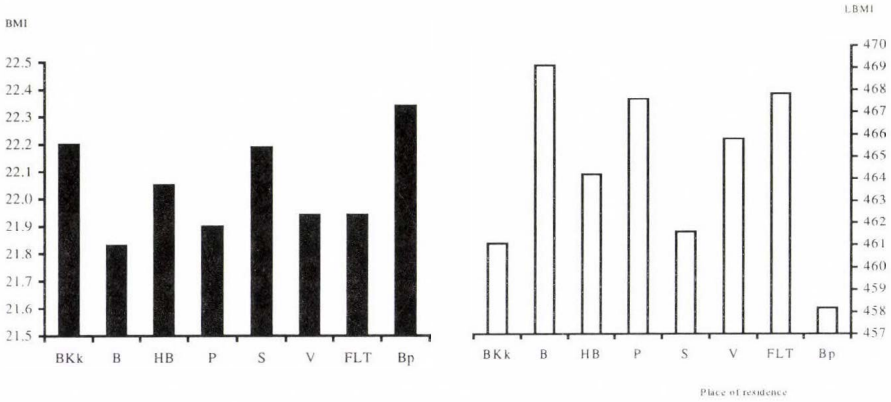

Figure 3: BMI and LBMI of the conscripts according to the place of residence.

The BMI increased and LBMI decreased in the university students according to the educational level of the parents. The changes were larger in the students with lower educated parents than in students with higher educated parents (Figures 4–5). The values of BMI in the conscripts were lower while the values of LBMI were higher in the conscripts than in the university students, which also show that they have less body fat than the students. Similar to the university students the conscripts with higher educated parents have less body fat than the conscripts with lower educated parents (Figure 6).

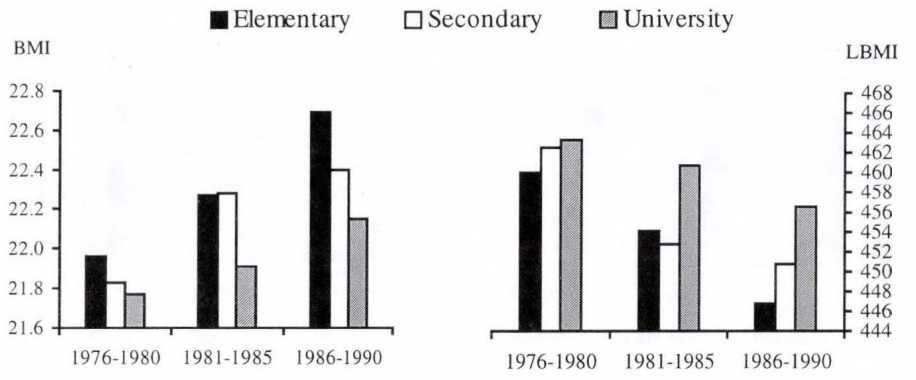

Figure 4: The BMI and LBMI of the male university students according to the educational level of the father.

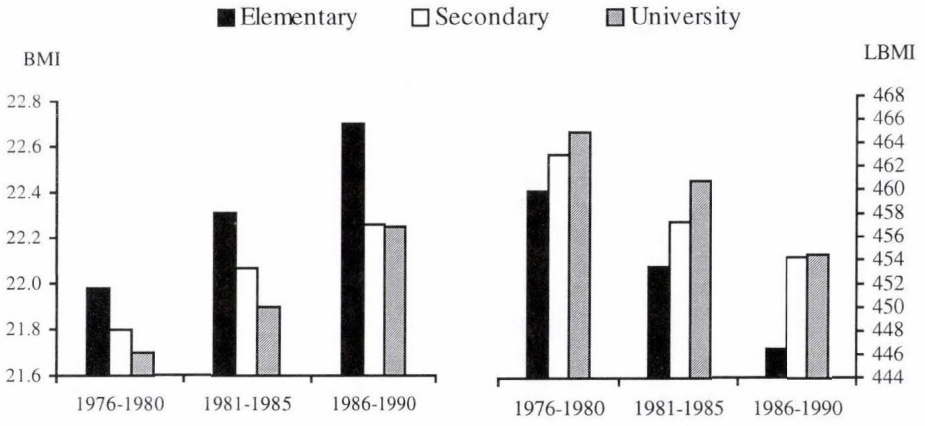

Figure 5: The BMI and LBMI of the male university students according to the educational level of the mother.

The usefulness of the BMI strongly suggested by the WHO (WHO TRS 894), for assessing overweight and obesity have been under debate for a long time. One of the main points of the criticism is that BMI is more a function of muscle and bone mass than fatness (Ross et al. 1988). The authors also showed that 26 per cent of the extremely lean individuals (BMI under 20) in the sample had skinfold totals above 50th percentile for the sample, while 16 per cent of the individuals rated overweighted (BMI above 27) had skinfold totals that were below the 50th percentile.

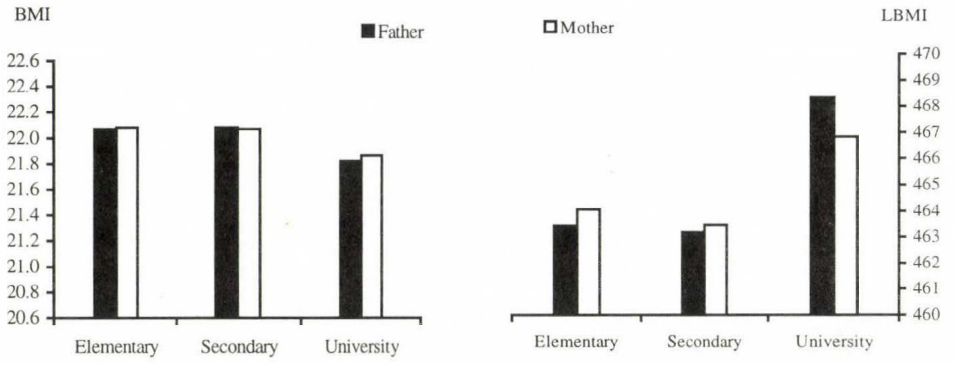

Figure 6: The BMI and LBMI of the conscripts according to the educational level of the parents.

The other main point of the criticism is that the distribution of the BMI is positively skewed and hence deviated considerably from normal distribution. That was the reason that Nevill and Holder (1995) proposed the use of LBMI, which was found to be both symmetric and normally distributed.

Our data showed only minor differences in the changes of the BMI and LBMI in the samples of conscripts and university students during the investigated period, although LBMI seemed to be a more sensible predicator of the body composition in the case of the socioeconomic factors than the BMI.

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