Anthrop. Közl. 30; 159–163. (1986)

ANTHROPOMETRIC CHANGES IN OBESE CHILDREN DURING WEIGHT-REDUCING SUMMER CAMPS

Ágota Muzsnai, L. Blatniczky, Zita Halász and *F. Péter*
Buda Children's Hospital and Polyclinic, Budapest, Hungary

Abstract: Two groups of obese children (age: 8–16) were camped for two and three weeks, respectively (34 and 57 children). In this period they were on a 1000 kcal daily diet, taking intensive physical exercises twice a day. Fluid intake was limited to 1000 ml. Measurements were taken in a three week camp with a similar program, too, but without restriction of fluid intake (101 children) before and after the camp. The skinfold thickness on triceps, biceps, subscapular and suprailiac was measured. Depending on age, density was calculated by the equations of Brook or Durnin and Rahaman, and fat% and fat content were calculated by the Siri-formula. On the basis of the data measured and calculated the authors analyses the changes in body weight and composition due to the different duration and fluid intake in the camps. The reliability of equations is sought when comparing the data of the two age-groups.

The body weight loss is proportional to the duration of the camp and to the restriction of the diet; the majority of weight loss is derived from body fat loss. It may be supposed that the actual thickness of the skinfold depends on the hydrated status of the organism as well; this fact may modify the value of the fat% determined by the skinfolds.

Key words: Obese children, Weight-reducing camps, Weight-loss, Body fat loss.

Introduction

Obesity is a condition difficult to define; a sort of deviation from the normal body proportion that concerns almost all components, mostly the adipose tissue. Children's obesity cannot be determined by a simple or repeated weighing: a child's weightgain doesn't necessarily mean fatgain, and the improvement in the proportion of the composition does not necessarily mean weight loss. The most significant changes in the growing organism are being brought about at the expense of the total body water. The quantity of muscle and adipose tissue, respectively, increases from time to time more or less as a function of age and sex (Friis-Hansen 1971), and in compliance with it the specific gravity (density) is also determined (Pařízková 1961).

The specification of body composition can be done by several methods. However, the invasive character of these methods rises paralell with their reliability and they require laboratory or hospital background. In general medical practice an objective method is needed to quantitatively determine the fat content of obese children.

Several investigators examining adult population have found close correlation between fat content assessed by physico-chemical methods and subcutaneous fat quantity. Their finding is that skinfold thickness and density clearly reflect body fat.

Durnin and Rahaman (1967) extended their studies to adolescents of both sexes aged 12 to 16 years, and set up two equations for the description of body density (Density for boys = 1.1533–0643xlog sum of the four skinfold thicknesses; Density for girls = = 1.1369–0.0598xlog sum of the four skinfold thicknesses). Brook (1971) investigated prepuberal obese and short statured children between the age of 1 and 11 years. He has modified the previous equations according to the total body water assessed (Density$^+$ for boys = 1.690–0.0788xlog sum of the four skinfold thicknesses; Density$^+$ for girls = = 1.2063–0.0999xlog sum of the four skinfold thicknesses).

We therefore have methods for assessing changes in fat of obese children imperfect they may be. In evaluating the data we also sought the reliability of methods.

Patients and Methods

During the school holidays we camped obese children aged between 8 and 16 years for two (34 children) or three (57 children) weeks. They were on a daily 1000 calorie (4187 kJ) diet taking intensive physical exercise twice a day. Fluid intake was limited to 1000 ml per day. There was a three week camp with a similar program in Kőszeg (101 children), but without restriction of fluid intake. In these obese children's backgrounds there was no evidence of endocrine disease, their weight-for-hight deviated from that of the normal by +3 SD (Eiben et al. 1971).

Data were collected at the beginning and at the end of camp, precisely 10 and 18 days, respectively. In addition to weighing the children we measured skinfold thickness by Lange caliper. In order to reduce errors in measurement the same doctor measured thickness on triceps, biceps, subscapular and suprailiac. The density of children over 11 years was calculated by the equations of Durnin and Rahaman (D), and those under 11 by the equation of Brook (D^+). Fat% was calculated by the Siri-formula (Siri 1956): Fat(%) = $= [(4.95/\text{density})-4.5]\times 100$. The multiplication of weight and the fat% made up the body fat content: Fat (kg) = fat%xbody weight/100.

The homogeneity of the pattern enabled us to concentrate on the degree of changes in weight, fat% and fat loss. The figures demonstrate the differences in data taken at the beginning and end of the camp, 10 and 18 days, respectively.

Results

According to the two different equations we illustrated (Fig. 1) our data separately (groups under 11 and over 11 years). The columns demonstrate the data of the camps. The first column shows the 10 days', the second one the 18 days' camp in the hospital and the third one the 18 days' camp in Kőszeg. By comparing the first two columns we can evaluate the effect of the duration, and by comparing the second and third columns the effect of the fluid restriction.

Looking at the outcome the long-lasting and more restricted fat-reducing diet yields the best result. Note, in the fat loss there is no significant difference ($p=0.54$) between these two groups: 18 days' > Kőszeg'.

Interestingly enough in the fat%-loss we discover significant difference ($p=0.03$) in the only group where the fat loss compared to the weight loss was not significant – remember the previous note (Fig. 2). And in addition, the value of the fluid restricted 18 days' group was lower than that of the liberal Kőszeg group: 18 days' < Kőszeg'.

This raises the suspicion that the mean values of fat loss are misleading. Therefore, we analysed the fat change individually, and compared the body fat loss to weight loss.

In the under 11 group we got relatively high values (Fig. 3). Twice as many children in a 10 days' period gained lean body mass than during a 18 days' period. It seems to be unrealistic. The value of about 40% of the Kőszeg camp seems rather unreal only in relation to the other age-group; in the second group there are only two children each per camp. Does the unbelievable fat loss calculated by the Brook equation show any relation to something?

In order to get an answer to the question raised we sought a connection with the other data available. The weight-for-height turned out to be indifferent. Definite correlation was discernible by the analysis of the fat%-change in fluid restricted camps (Fig. 4).

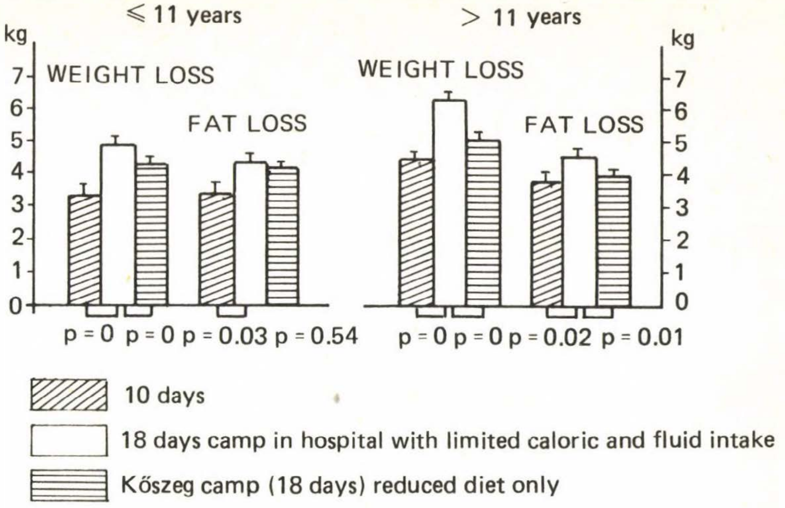

Fig. 1: The degree of the weight loss measured and that of the fat loss calculated at the end of the camps

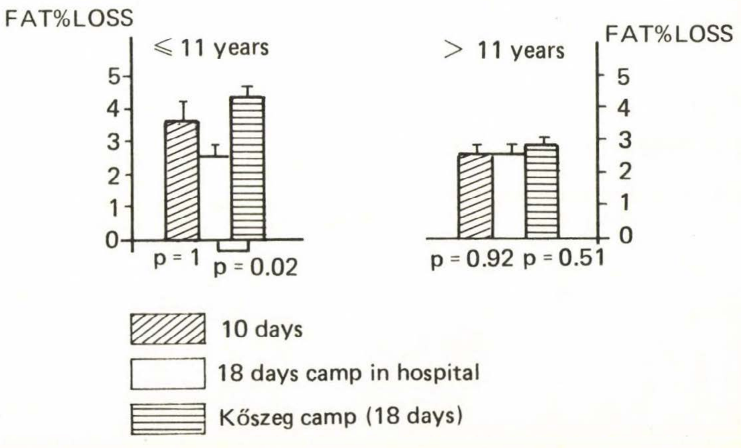

Fig. 2: The degree of fat%-loss at the end of the three different (see above) camps

Firstly we divided the children into two groups on the basis of the relation between body weight loss and fat loss. We than analysed the fat%-loss of the separated groups. We found that in the critical groups (fat loss > weight loss) of the 10 days' camp fat% values move between 3.3 and 8.0, and no cases belonging to the other group has 3.3 or higher value in fat%-loss. Similar correlation was found in the 18 days camp, but the limit is in the fat%-loss at 5.5 However, though the correlations seem to be similar, note that the distances from mean values are different.

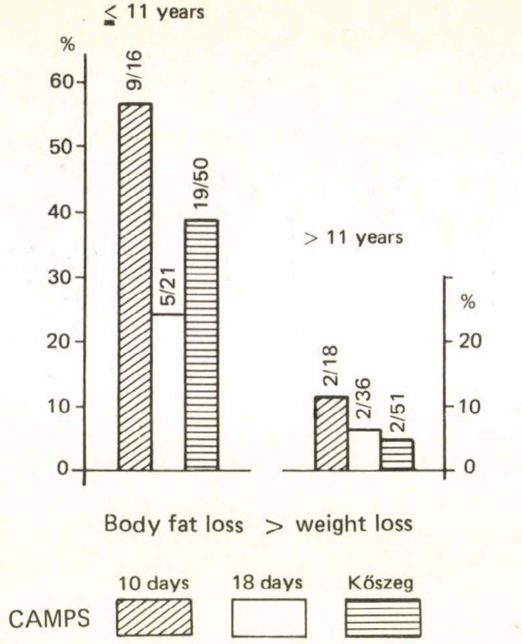

Fig. 3: The cases where fat loss exceeds weight loss compared to the total number of the children in the camps.

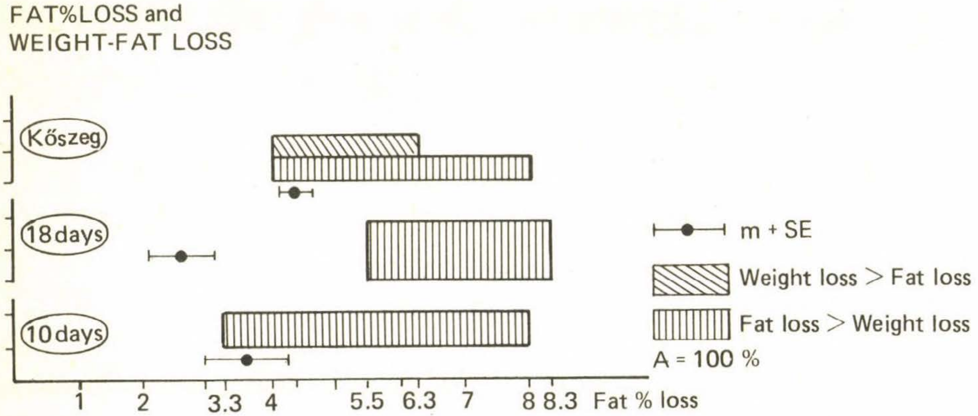

Fig. 4: The correlation between the fat%-loss and the fat loss compared to the weight loss

Conclusions

1. In summerising the weight changes we may state that the primary aim was achieved. The children lost weight depending on the time factor and on limitation of fluid intake. The majority of their body weight loss came from fat loss.

2. Concerning the skinfold change on the basis of fat%-loss (Kőszeg' > 10 days' >

> 18 days') we may admit: *(a)* the skinfold change is independent of fluid restriction (Kőszeg' > 18 days'), and *(b)* the skinfold of obese children contains some other material with a quicker turn over than fat (e.g. water).

3. Analysing the cases where fat loss exceeds body weight loss, and

4. comparing these to the fat%-loss raises the suspicion that unreal fat loss may perhaps derived from water loss.

The validity of the two equations of Durnin's and Brook's are different, which queries the reliability of the data calculated. We concluded that at the next investigation we have to extend our research over the water balance of obese children as well: The reason for this is that we suppose the thickness of skinfold is partly a result of the hydrated status of the organism. This will give a definite answer to the question in so far as the usefulness of the equations is concerned.

References

BROOK, C. G. D. (1971): Determination of body composition of children from skinfold measurement. – Arch. Dis. Child. *46;* 182–184.

DURNIN, J. V. A. G. – RAHAMAN, M. M. (1967): The assessment of the amount of fat in the human body from measurements of skinfold thickness. – B. J. Nutr. *21;* 681–689.

EIBEN, O. – HEGEDŰS, GY. – BÁNHEGYI, M. – KIS, K. – MONDA, M. – TASNÁDI, I. (1971): *Budapesti óvodások és iskolások testi fejlettsége (1968–1969).* – Budapest Fővárosi Közegészségügyi–Járványügyi Állomás, Budapest. p. 99.

FRIIS-HANSEN, B. (1971): Body composition during growth. In vivo measurements and biochemical data correlated to differential anatomical growth. – Pediatrics *47;* 264–274.

PAŘÍZKOVÁ, J. (1961): Age trends in fat in normal and obese children. – J. Appl. Physiol. *16;* 173–174.

SIRI, W. E. (1956): Body Composition from fluid spaces and density. MS UCRL 3349. – Donner Laboratory, University of California.

Mailing address: Dr. Ágota Muzsnai
Budai Területi Gyermekkórház
P.O.Box 14. H–1277 Budapest, Hungary