Anthrop. Közl. *32;* 191–195. (1989/90)

ANTHROPOMETRIC ASSESSMENT OF OBESE CHILDREN WITH SPECIAL REGARD TO THE DIFFICULTIES OF EARLY DIAGNOSIS AND CALCULATING BODY FAT PERCENTAGE

L. Blatniczky, Á. Muzsnai, Zs. Kovács and *F. Péter*

Buda Children's Hospital, Budapest, Hungary

Abstract: *Weight, height and seven skinfold thicknesses [triceps (a), biceps (b), subscapular (c), abdomen (d), suprailiac (e), thigh (f), calf (g)] were measured using Lange skinfold caliper in 1086 (466 boys, 620 girls) obese children aged 7–15 years. Percentile curves of Σ4 skinfolds (c, d, e, f) were formed according to the height-age and related to reference curves of Budapest children. Correlations between Σ7-, Σ4- and individual skinfold thicknesses and weight-for-height were analysed. In 788 Budapest-children, and 393 obese children aged 11–12 years body fat% was calculated using Parízková and Roth's, Durnin and Rahaman's and Brook's formulas and the results were compared to each other. Correlation between Σ7 and Σ4 skinfold thicknesses in obese children is r = 0.984. A slight relationship can be detected between Σ4 skinfold thickness and weight-for-height. Whereas Σ4 skinfold thickness determination is suitable to detect obese patients, height and weight measurements applied in Hungarian practice of pediatrics, and weight-for-height calculation is inadequate. This accounts for the fact that very few, if any, obese children sent our hospital have had Σ4 skinfold thicknesses value between 90–97 percentile. Different average body fat% calculated by four types of formulas in the same samples underline the necessity of using these with some reservation. The comparison of skinfold thicknesses with percentile curves during the treatment and control of obese children is more objective.*

Key words: *Body composition; Skinfolds; Obesity; Budapest children.*

Introduction

The degree of obesity in children sent to our outpatient clinic was detected comparing to the scores in percentile deviation of skinfold thickness in Budapest children (Halász, Blaltniçzky, Kovács, Muzsnai and Péter, in this volume). Subsequently it was studied which skinfold values reflect body fat in the most optimum way, how informative was weight-for-height calculation and how comparable were the formulas generally used in Hungary for calculating body fat percent.

Subjects and methods

In a total of 1086, 7–15 year old obese children (466 boys, 620 girls), who were sent to our endocrine clinic by GPs, in addition to measuring height and weight, skinfold thicknesses were measured at 7 points on the left side of the body [triceps (a), biceps (b), subscapular (c), abdomen (d), suprailiac (e), thigh (f), and calf (g)] using the Lange skinfold caliper (Lange and Brožek 1961). Weight-for-height and height-age were calculated using Eiben and Pantó's data (1987). Values of Σ7 (a–g) and Σ4 skinfold thicknesses (c, d, e, f) and percentile division according to height-age were calculated and the latter was compared with the reference data of Budapest children. Correlation (r) of the Σ7-, Σ4- and individual skinfold thicknesses and weight-for-height were calculated in both sexes.

Body fat% was calculated from skinfold thickness values of the 11–12 years age Budapest children (377 boys, 414 girls) and obese children (149 boys, 244 girls) using the formulas of Pařízková and Roth (1972), Durnin and Rahaman (1967) as well as that of Brook (1971) (Table 1) and the values obtained were compaired using unpaired *t* test.

Table 1. **Formulas used in calculation of body fat%**

Author(s)	Sex	Formulas	Recommended age (year)
Pařízková and Roth	♂	Fat% = 35.044xlog(tric.+bic.)–25.877	8–13
		Fat% = 31.381xlog(tric.+bic.+subscap.+suprailiac+calf)–31.890	
Pařízková and Roth	♀	Fat% = 41.329xlog(tric.+bic.)–34.862	8–13
		Fat% = 36.688xlog(tric.+bic.+subscap.+suprailiac+calf)–39.570	
Durnin and Rahaman*	♂	D = 1.1533–0.0643xlog(tric.+bic.+subscap.+suprailiac)	≥ 11
	♀	D = 1.1369–0.0598xlog(tric.+bic.+subscap.+suprailiac)	
Brook*	♂	D = 1.1690–0.0788xlog(tric.+bic.+subscap.+suprailiac)	≤ 11
	♀	D = 1.2063–0.0999xlog(tric.+bic.+supscap.+suprailiac)	

*Fat% was calculated by Siri's (1956) formula

Results

Data in Table 2. reveal that, in obese children, on the basis correlation between the Σ 7 skinfold and individual skinfold thicknesses, most revelant are in declining importance: suprailiac, subscapular, thigh, abdomen, on something like to Budapest children (Halász, Blatniczky, Kovács, Muzsnai and Péter, in press) but in alter sequence. The correlations between weight and the Σ 7-, Σ 4- and individual skinfold thicknesses in obese children are usualy slight.

Table 2. **Relationships (r) between Σ 7, Σ 4 skinfold, weight-for-height and individual thicknesses in obese children**

	Triceps (a)	Biceps (b)	Sub-scapular (c)	Abdomen (d)	Supra-iliac (e)	Thigh (f)	Calf (g)	Weight-for-height	Σ 4 skinfold thickness
Σ 7 skinfold thickness	0.71	0.63	0.76	0.74	0.79	0.76	0.70	0.52	0.988
	0.73	0.57	0.81	0.79	0.82	0.80	0.68	0.57	0.981
Weight-for--lenght	0.39	0.38	0.48	0.46	0.34	0.34	0.28	–	0.290
	0.51	0.29	0.56	0.50	0.44	0.41	0.25	–	0.366

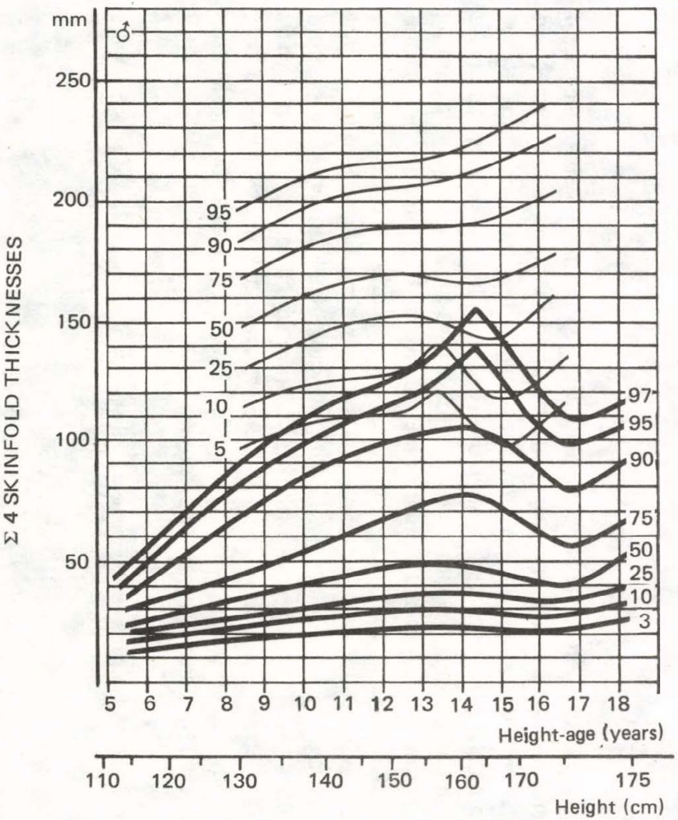

Figure 1: Percentile division of Σ 4 skinfold thicknesses in obese children (dotted lines) compared with the reference curves of Budapest children (solid lines) Boys

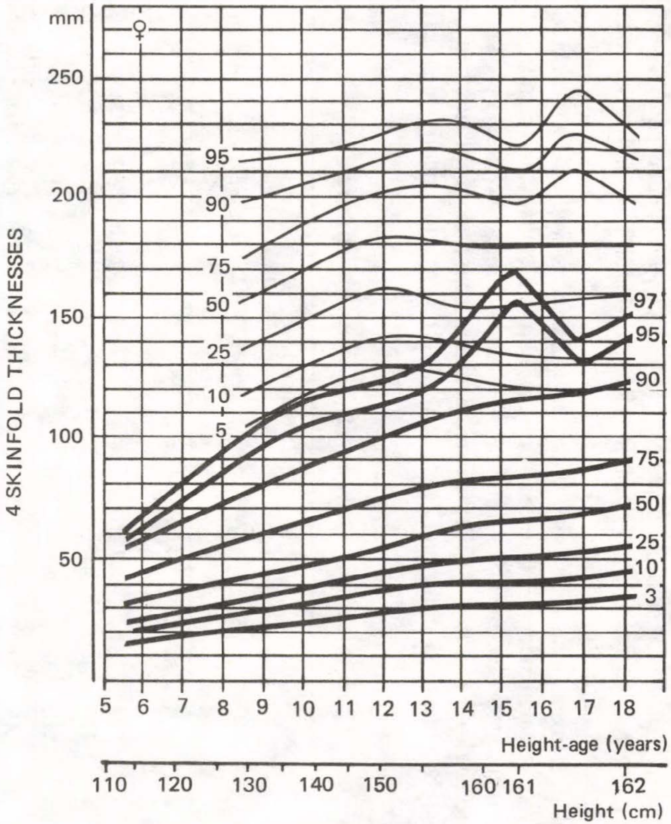

Figure 2: Percentile division of Σ 4 skinfold thicknesses of obese children compared with the reference curves of Budapest children (solid lines) Girls

As Figures 1 and 2 show, Σ 4 skinfold thickness of obese children under the 11 vs. 13 height-age groups were higher than the 97 centile reference values, that is, that the ones who are not sent to our clinic.

Data in Table 3 reveal that within the Budapest children as well as in the obese groups fat% values calculated by different formulas showed statistically significant differences in all comparisons. Brook's formula (1971) gives a highly deformed picture. The formula of Pařízková and Roth (1972) which calculates from 5 skinfold thicknesses and the one suggedsted by Durnin and Rahaman (1967) give biologically identical results.

Table 3. **Calculated body fat% in 11–12 years old children**

Author(s)	Body fat%							
	Budapest children				Obese children			
	boys (n=377)		girls (n=411)		boys (n=149)		girls (n=244)	
	$\bar{x}$	± s	$\bar{x}$	± s	$\bar{x}$	± s	$\bar{x}$	± s
Pařízková and Roth								
(2 skinfolds)	19.4	7.0	19.7	6.6	34.6	2.7	36.7	3.2
(5 skinfolds)	21.6	6.1	24.4	5.9	37.9	2.7	42.2	2.5
Durnin and Rahaman	21.1	6.5	26.4	5.0	37.5	2.1	40.8	2.1
Brook	24.4	8.0	24.8	8.31	45.0	2.7	49.9	2.1

$p < 0.05$ in all comparison

Conclusions

Four skinfold thicknesses in obese children gives enough information about the extent of obesity, whereas – if it includes the values measured on the trunk – helps to screen the children who are increasingly at risk from the viewpoint of metabolic differences. Weight-for-height calculation in obese children does not seem to be objective. Therefore moderately obese children or the ones who have excess weight cannot be detected by discriminating upon body height and weight in the practice of Hungarian pediatrics and this fact excludes the possibility of treating them in an early phase of the illness. Formulas for calculating fat% give deformed information. One of the reasons is that advancing height-age, taking place with the physiological growth of skinfold thicknesses, cannot be effectively proved in a calculation which includes several years and is made on the basis of stiff formulas. We therefore think that in everyday practice, primarily during the treatment and control of one child, the comparison of skinfold thicknesses with reference curves is more objective.

*

Paper presented at the 6th Congress of the European Anthropological Association, Budapest, September 1988. Received September, 1988; revision received 20 March, 1990.

References

Brook CGD (1971): Determination of body composition of children from skinfold measurements. – *Archives of Disease in Childhood, 46;* 182–184.

Durnin JVGA, and Rahaman MM (1967): The assessment of the amount of fat in the human body from measurements of skinfold thickness. – *British Journal of Nutrition, 21;* 681–689.
Eiben OG, and Pantó E (1987): A 3–18 éves fiúk és lányok testmagasság, testtömeg és testmagasságra vonatkoztatott testtömeg referencia értékei. – *Gyermekgyógyászat, 38;* 242–253.
Halász Z, Blatniczky L, Kovács Zs, Muzsnai Á, and Péter F (19): Anthropometric assesment of 6–14 year old Budapest children. – *Anthrop. Közl., In: 32;* 185–189.
Lange KO, and Brozek J (1961): A new model of skinfold caliper. – *Am. J. phys. Antrop., 19;* 98–99.
Parízková J, and Roth Z (1972): The assessment of depot fat in children from skinfold thickness measurements by Holtain (Tanner/Whitehouse) caliper. – *Human Biology, 44;* 613–620.
Siri WE (1956): *Body composition from fluid spaces and density.* – MS UCRL 3349. Donner Laboratory, University of California.

Mailing address: L. Blatniczky, M. D.
Buda Children's Hospital
P.O.Box 14.
H–1277 Budapest 23, Hungary