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Anthropometric considerations regarding obese children

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Some anthropometric variables and body composition were studied in 62 obese children ranging in age from 7 to 14 years. Body fat per cent was estimated by prediction equations from five skinfolds and compared to the percentual value of body weight referred to the stature.

The importance of body composition in the individual anthropometric assessment of obese patients is stressed, since evident discrepancies have been found when comparing these criteria. The per cent of body fat is the reliable indicator of the degree of obesity.

Obesity, in spite of being a common pathological condition, has no satisfactory definition [1, 5]. Different indices have been suggested for its characterization [9, 18] of which excess body weight relative to age and the ratio of standard reference weight for height (IW/AH) are those mostly used [10, 11]. Still, these indices include cases with heavy lean body mass, and obesity and overweight cannot be regarded as synonyms, because muscular development, body build and the changes in body composition are all to be taken into consideration.

In the last 20 years much progress has been made in the estimation of body composition, allowing to determine with great accuracy the proportion of body fat and lean body mass. The most common methods are based on skinfold measurements and these, being simple, safe and painless, are suitable for routine use in children [4, 15].

We have performed anthropometric assessments in obese children, taking into account the above-mentioned considerations.

Material and Methods

Thirty girls and 32 boys ranging in age from 7 to 14 years have been studied. In each of them, the stature was measured to the nearest mm and body weight to the nearest 0.1 kg, and the IW/AH was calculated. Skinfold thicknesses were obtained with a Holtain caliper with 10 g/mm² standard pressure on the right side at 5 sites (biceps, triceps, subscapular, suprailiac, and calf) and were recorded in duplicate by the same trained examiner.

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Skinfolds were estimated by the standard technique [20], except that the subscapular skinfold was taken at an angle of about 45° to the vertical, and the suprailiac skinfold was measured immediately above the iliac crest in the mid-axillary line [3].

Body fat per cent was estimated by the prediction equations from five skinfolds for girls and boys [12] as follows:

$y = 39.024x - 43.435$ for girls, and

$y = 29.344x - 27.410$ for boys, where

y = fat in per cent of body weight, and

x = log of the sum of the 5 skinfold measurements.

In each patient, X-rays were made of the wrist area to determine skeletal age according to the Greulich—Pyle atlas [7].

Means and standard deviations were calculated for all measurements and compared to the data obtained by Eiben in Hungary. Student's t-test was used for binary comparisons. The Pearson correlation coefficient and regression lines were also assessed [17].

Results

In Tables I and II are shown the means, standard deviations and the significant differences of the anthropometric data of obese patients and those to be found in Eiben's study.

Fig. 1 demonstrates the body of obese girls and boys, plotted on weight-age charts. Fifteen boys and 13 girls were over the 97th percentile, and only 3 of each sex were between the 75th and 90th percentiles; the latter exhibited the smallest height. The distribution of height in both sexes is shown in Fig. 2. The height of almost all children was at or over the 50th percentile, as reported by other authors, too [6, 8.]

Fig. 3. compares 5 skinfold thicknesses in normal and obese girls and boys of different ages. The fat distribution in both sexes was similar as that obtained by Parizkova [14]. There were no sex differences in the amount of subcutaneous fat. The greatest deviation from the standard values was observed in the subscapular skinfold.

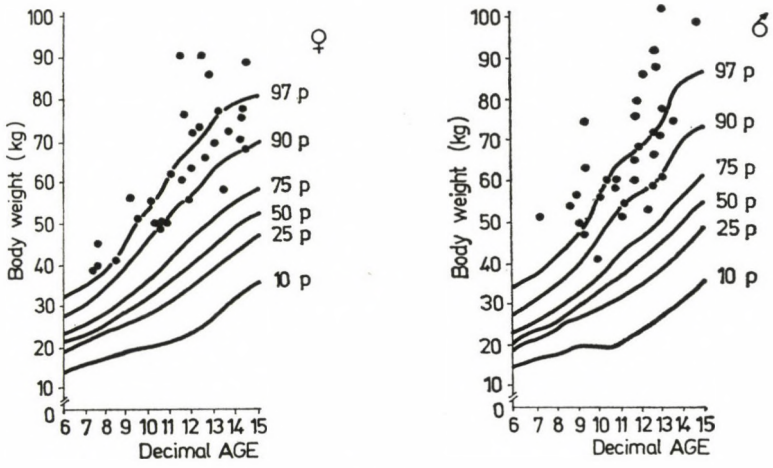

Fig. 1

TABLE I

Mean values of somatic indicators in obese girls and control group at different ages

			Weight (kg)	Stature (cm)	TS (mm)	BS (mm)	SS (mm)	SI (mm)	CALF (mm)
	Control	x	31.06	137.97	12.10	7.70	9.46	13.19	14.32
10 years		S.D.	5.66	7.24	4.14	3.37	5.28	6.59	5.02
	Obese	x	53.23****	145.55**	18.03****	10.53	26.93****	22.16***	22.87****
		S.D.	5.30	1.96	1.60	2.17	4.15	4.21	4.32
	Control	x	35.30	144.07	11.72	8.21	9.89	14.07	14.21
11 years		S.D.	7.00	5.41	4.16	3.66	5.90	7.63	4.88
	Obese	x	69.33****	157.86****	23.34****	12.48**	24.48****	21.88*	23.36****
		S.D.	14.07	8.87	5.55	2.34	7.40	6.34	2.71
	Control	x	40.28	148.09	12.18	8.12	11.17	15.29	15.30
		S.D.	8.26	6.19	5.50	3.98	7.61	9.63	6.36
12 years	Obese	x	76.30****	158.23****	24.77****	13.23***	26.03****	23.63*	32.07****
		S.D.	9.31	8.53	3.46	1.93	4.36	3.70	4.20
	Control	x	45.36	155.80	12.89	8.61	12.45	16.49	15.76
		S.D.	8.53	6.48	5.63	3.78	6.58	8.43	5.79
13 years	Obese	x	69.47****	155.43	21.13**	11.07	22.27*	22.60^{ns}	22.33
		S.D.	9.79	4.38	6.0	3.80	7.13	9.95	5.15
	Control	x	48.77	158.26	14.22	8.88	13.63	17.50	16.63
		S.D.	8.31	5.83	5.61	3.66	6.19	7.95	5.79^{ns}
14 years	Obese	x	76.08****	158.58	21.90***	11.44	24.04****	18.68^{ns}	21.92^{ns}
		S.D.	7.93	4.60	6.71	2.54	7.70	4.56	9.18

*$p < 0.05$ **$p < 0.02$ ***$p < 0.01$ ****$p < 0.001$; TS = triceps skinfold; BS = biceps skinfold; SS = subscapular skinfold; SI = suprailiac skinfold

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TABLE II

Mean values of somatic indicators in obese boys and control group at different ages

		Weight (kg)	Stature (cm)	TS (mm)	BS (mm)	SS (mm)	SI (mm)	CALF (mm)
9 years	Control x	28.91	137.87	10.34	6.27	6.93	10.29	11.68
	S.D.	5.27	6.36	4.03	2.88	4.33	7.73	5.60
	Obese x	55.60****	143.12****	21.08****	12.92****	22.48****	19.20**	24.52****
	S.D.	10.63	6.72	5.42	4.32	8.81	5.53	5.19
10 years	Control x	32.33	139.10	10.30	6.37	8.13	11.92	12.07
	S.D.	6.44	6.28	4.47	3.57	5.60	8.94	5.78
	Obese x	57.74****	146.80**	19.40****	11.76***	21.68****	19.44	23.30****
	S.D.	7.86	10.33	3.91	3.28	2.59	6.96	4.17
11 years	Control x	34.40	142.46	10.31	7.01	8.38	12.59	12.35
	S.D.	6.45	6.22	5.37	4.34	6.05	9.99	6.67
	Obese x	63.88****	154.88****	19.77****	11.60**	21.87****	18.80	27.52****
	S.D.	11.87	12.48	3.63	2.20	5.54	4.93	5.39
12 years	Control x	38.78	148.26	10.82	7.04	8.96	12.87	13.20
	S.D.	7.69	6.86	5.03	4.23	5.89	8.99	6.29
	Obese x	78.89****	155.78***	25.38****	14.31****	31.22****	23.56****	31.37****
	S.D.	17.83	6.79	5.08	3.06	4.93	5.15	8.53
13 years	Control x	43.79	155.21	10.21	7.17	9.15	13.29	13.33
	S.D.	9.24	8.39	5.26	4.08	6.81	9.92	5.90
	Obese x	70.70****	158.43	18.65***	9.85	24.80****	20.35	24.75****
	S.D.	6.79	3.32	4.10	0.97	6.44	2.51	3.18

*$p < 0.05$ **$p < 0.02$ ***$p < 0.01$ ****$p < 0.001$

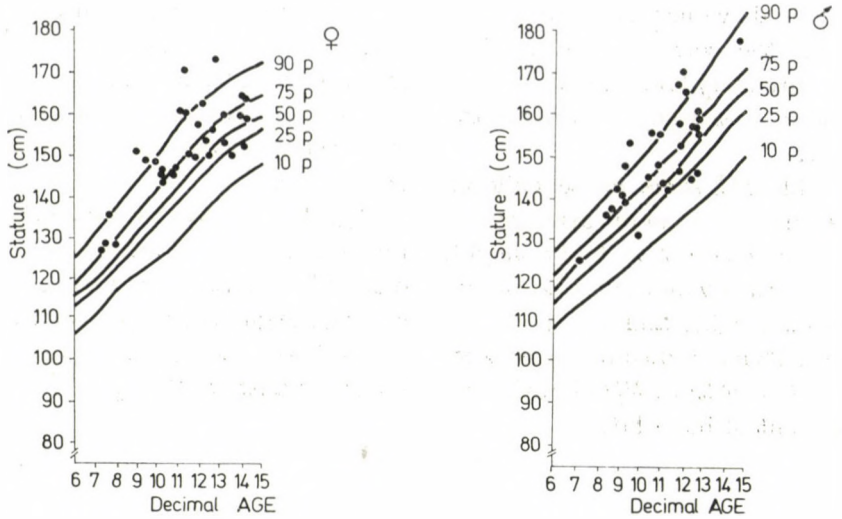
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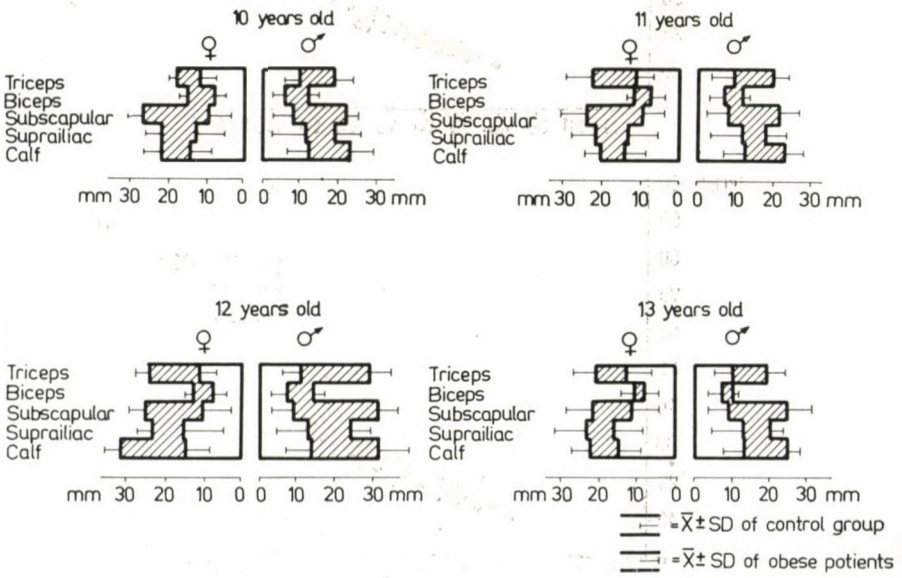
FIG. 2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= X̄ ± SD of obese potients

FIG. 3

Individual values and regression line with the correlation coefficient for absolute body fat and body weight in obese girls and boys are presented in Fig. 4.

In Table III some obese children similar in height were arranged in pairs, to compare their body weight, the percentual value of ideal weight for actual height, and the body fat per cent. Evident discrepancies were found between the IW/AH ratio and the per cent of body fat.

Heavier children exhibited greater amounts of body fat, but this was not the rule. This is seen in Fig. 5, where of 2 patients with the same stature the heavier was less obese than the higher.

Fig. 6 presents the correlation obtained between skeletal age and chronological age. Some patients, mainly among the girls, displayed an acceleration of skeletal age, as reported also by other authors [2, 8].

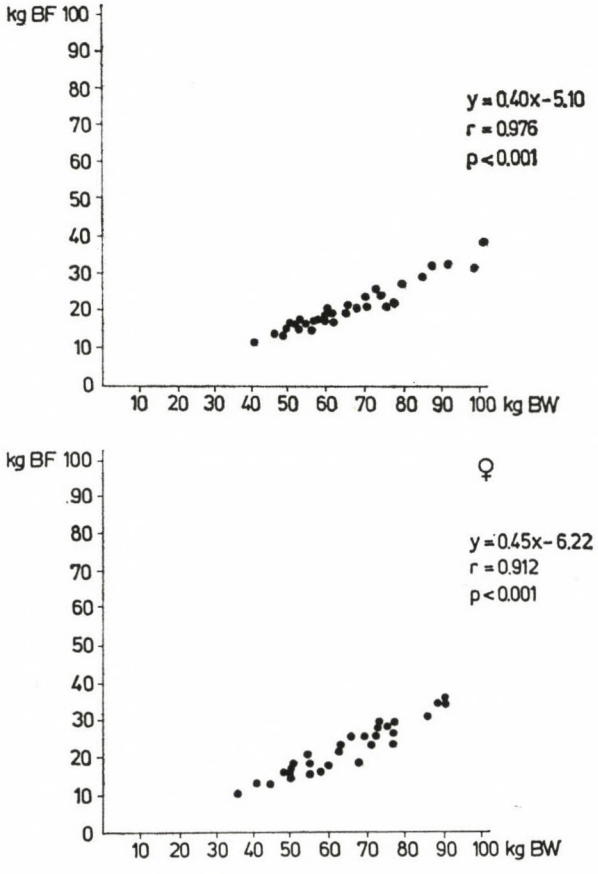

FIG. 4

TABLE III

Paired comparison of obese children similar in height

Patient	Height, cm	Body weight, kg	IW/AH per cent	Body fat per cent
1. girl	148.8	55.30	133.96	36.24
2. girl	149.0	55.30	133.96	33.03
3. girl	160.1	77.10	142.74	37.84
4. girl	163.0	77.00	138.04	30.63
5. boy	145.4	52.5	131.91	32.33
6. boy	145.4	57.4	144.22	31.10
7. boy	153.8	62.0	140.75	28.27
8. boy	153.8	61.4	139.48	31.67

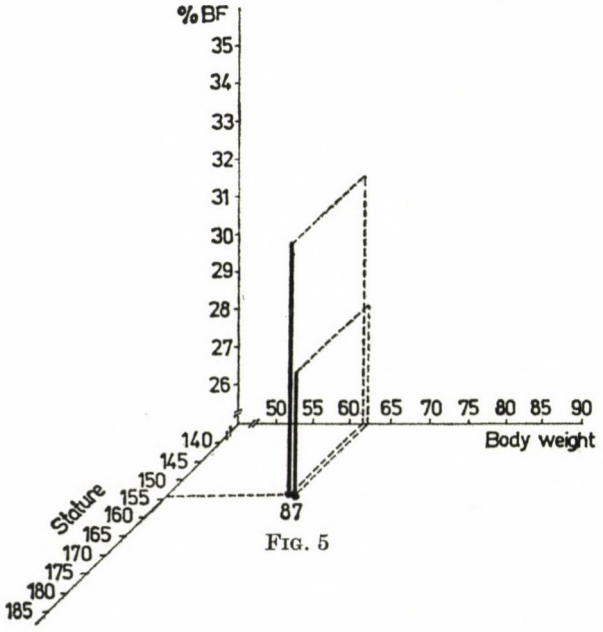

FIG. 5

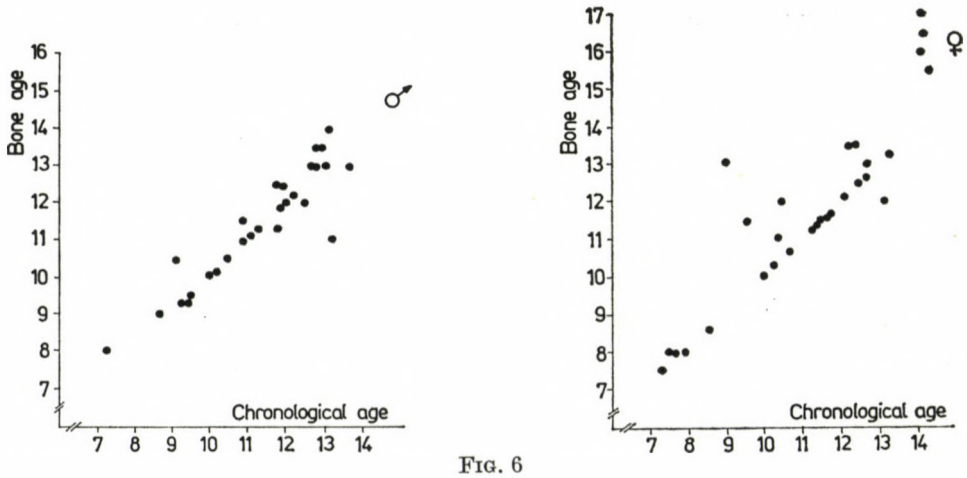

FIG. 6

Discussion

In the assessment of the nutritional status in a community, the percentile of body weight for age, or the percentual value of body weight referred to height may yield sufficient information. In paediatric practice, however, individual assessment is necessary, and for this purpose more reliable data are needed.

The index IW/AH is the most widely used indicator of obesity [18] because it allows a fairly satisfactory estimation of overweight children in field-work. In clinical studies, however, the body composition, the per cent of body fat and/or the per cent of lean body mass must also be taken into consideration. First of all, not all overweight individuals are obese, and many subjects with high lean body mass have been classified in that manner; on the other hand, if some of the body tissues have been replaced by fat, obesity may be present, although the body mass lies within the accepted limits [5]. To test this, paired comparisons were performed (Table III). This method revealed basic discrepancies.

Patients 1 and 2 had practically the same height, their body weight and their IW/AH values were identical, thus, according to this index they had the same degree of overweight. Still, when the per cent of body fat was calculated for each of them, patient 1 was found to have more body fat than the other.

Patients 3 and 4 differed in their IW/AH by 4.7%, but in the per cent of body fat a greater difference was obtained. Therefore, the quantitative information offered by the IW/AH ratio is not always proportional to the actual fat mass, and in some cases the information is paradoxial. For example, patient 5 had a lower body weight and a lower IW/AH ratio than patient 6, but a higher per cent of body fat. The same was the situation with patients 7 and 8, in that both had the same height with a small difference in body weight, but although the heavier one exhibited a slightly higher IW/AH ratio, he was less obese than patient 8 (Table III, Fig. 5).

The method allows reliably to assess the proportion of the fat mass and its changes in response to dietetic treatment or physical training programmes, as it has been observed by some authors [13]. At the same time, there are cases in which exercise and/or dietary treatment causes a change in body composition without a loss of weight. These cases must be considered successful [14] and thus, if a reliable study of metabolic variables is done in obese individuals, their body composition must be taken into consideration.

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