

# CONTROL OF BODY COMPOSITION AS A CRITERION OF SUITABILITY OF REDUCTION THERAPY IN OBESE CHILDREN

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Reduction of excessive fat in obese children in the period of growth and development is very weighty and delicate problem. In regard of the fact that absolute or relative preponderance of caloric intake over output is considered to be the principal cause of hyperalimentary obesities (which are by far the most numerous, in our experience), such metabolic defects are treated by reducing the supply of calories and fluids. The result of the reduction is then estimated according to decreases in weight, and/or according to changes in the weight — height relation. Numerous observations of the authors have shown, however, that loss in weight is not always caused only by the reduction of fat, but — largely in the later stages of reduction therapy — also by reducing the active mass; this often takes place if, first of all, a drastic limitation of food intake is applied without increasing the energy output. The reduction in children is to be performed with far higher care than in adults, because here a developing organism is concerned, whose natural tendency is to grow and enlarge, and not the reverse. That is why some authors, e.g. Mayer and others, recommend for a child not to reduce its weight, but rather to correct its mode of life so that the child may continue growing up and not put on as long as its weight is in line with its age and height. This is surely the most physiological, but also the most difficult way of treatment. — However, such treatment is hardly observable in cases of extreme obesity (e.g., a boy of 15 years whose weight is 125 kg at a height of 162 cm will hardly ever "grow up" to reach his appropriate weight).

Not only the question crops up what treatment would be the most suitable and effective for hyperalimentary obesity in infant age, but in the first place, how to control best not only the efficiency, but also the suitability of the respective way of treatment used in the period of growth.

It is necessary that reduction of weight should take place at the expense of excessive fat, and not by diminishing the active mass. Thus, the best control is that which measures directly the proportions and absolute quantities of both the active mass and the fat.

In the course of a holiday regime therapy we have repeatedly studied the influence of diet of varying

caloric values and compositions and arrived at the following conclusions: the caloric value of a diet ought to be such as to cover the basal metabolism of the child and its growth in accordance with the stage of its development; in a part of children a temporary stop of growth in height was the result of a temporary reduction of the caloric value of the diet to 1,000 calories per day. Bruch demonstrated a marked decrease of spontaneous moving activity in 160 obese infants. Johnson, on comparing the caloric intake and the moving activity, found rather a lower caloric intake in obese girls as compared with the normal ones, but, on the other hand, he found a markedly decreased moving activity in them. During a stay in summer camps with an intensive physical culture programme all obese girls decreased their weight considerably. This way of regime therapy proved to be of a high effectivity even in our children, even if the effective time was relatively short. The regime therapy for our children consisted of three parts:

a) a varied diet containing 1,700 calories per day with limitation of the carbohydrate and fat components and major emphasis on proteins and a maximum fluid intake of 1,500 ml a day;

b) an intensive regime of movement utilizing every form of physical training;

c) the educational component — correction of wrong movement habits both in the consumption of the overall quantity of food and its choice; acquisition of good movement habits (regular exercise, sufficient movement in the fresh air, etc.).

The control of body composition was performed by repeatedly measuring the body composition, i.e., the ratio of lean body mass and depot fat by determining the body density by the method of hydrostatic weighing with simultaneous determining of air volume in the lungs using the nitrogen dilution method of Keys and Brožek in our modification.

We further measured the skinfold thickness with calipers in ten different spots of the body surface. Our observations were made on eleven selected children (7 boys — average age at the first examination 11 years and 7 months; 4 girls — average age at the first examination 12 years and 2

months) for a period of three years during which these children came regularly to the outpatient department for obese children at the Pediatric Clinic, Medical Faculty, Charles University, Prague, and subsequently, always during their holidays, went repeatedly to a treatment — recreation camp for 6 to 7 weeks, where the principles of regime therapy found particularly strict application. Those were especially persistent cases of children's obesity, which had been studied by the clinic for a long time.

The children had been obese mostly since their early age, in some of them obesity began developing in the convalescence period following injury, otitis, tonsilectomy, and the like. According to common clinical examination no marked anomalies in the activity of the endocrine glands were found.

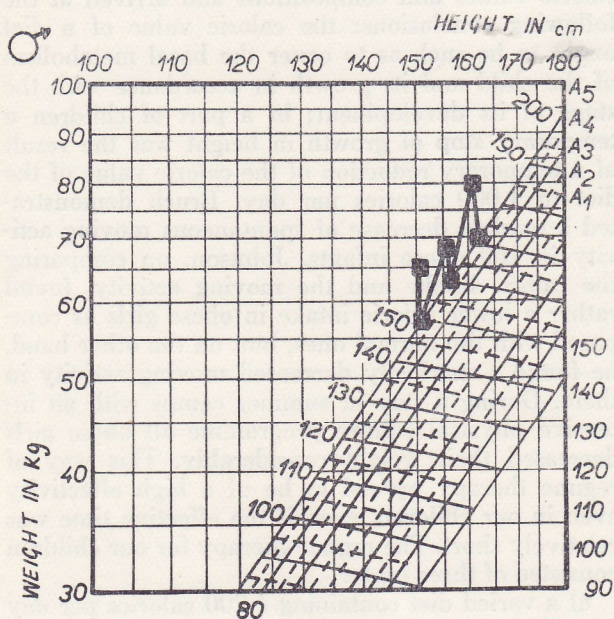


FIG. 1a

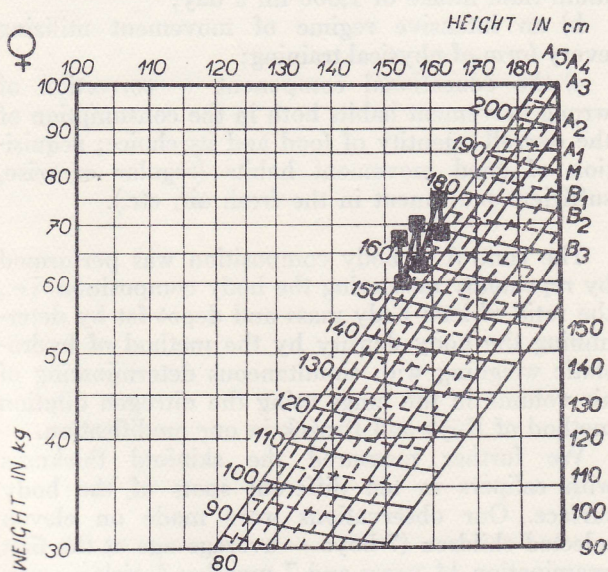


FIG. 1b

As to the physical development of the children, all of them were tall apart from their high weight and percentage of fat, as it appears from comparing the average height in the respective years of examination (Fig. 1, a + b). In calculating the body composition we can further see that the absolute quantity of the lean body mass in organisms of obese children is much higher than would correspond only to the height difference, which means that these children possess a much more robust constitution even as regards the development of the skeleton and the muscles.

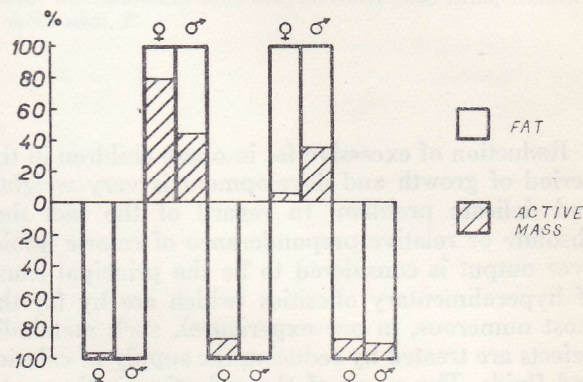


FIG. 2

Composition of weight losses and gains in obese children in various periods of reduction therapy

Tables 1 and 2 indicate the average weight, height, body density and fat percentage during the respective years of observation (examinations of body development and composition indicators were always performed before and after the summer treatment — recreation camps; moreover, the analogous values of the individual indicators found in children from a normal population are given for the sake of comparison. As it is to be seen, after 7 weeks in treatment camps, the average weight markedly decreases within the approximate range of 10 to 12 percent of the original value. At the same time the body density of the organism markedly increases, i.e., an essential elevation of the ratio of active mass and a decrease of the ratio of fat occur, as is indicated also by the percentage of lowered fat. A comparison with the values obtained in children of a normal population indicates that, not in a single year complete normalization of either weight or body composition was reached; yet a marked improvement was always registered. As Fig. 2 shows, the composition of weight losses and gains (calculated according to Entenmann et al., 1958) consisted of different proportions of both fat and active mass. The weight losses after stay in treatment centres consisted of fat, in the first place; according to these calculations a certain reduction of lean body mass occurred in girls, but only to a slight extent. In view of the fact that we had no possibility of checking, after the reduction of weight, simultaneously also changes of the water content in the organism (which also influence the resultant value of body density), we,

TABLE 1

Girls	1st year			2nd year			3rd year		
	treatment in the camp		normal values	treatment in the camp		normal values	treatment in the camp		normal values
	before	after		before	after		before	after	
height	153.0	153.1	148.0	157.3	157.3	153.0	161.9	161.9	157.0
weight	6.4	4.6	7.0	1.0	2.3	7.5	5.8	6.2	7.0
	67.3	60.0	40.0	70.4	63.5	45.5	75.5	68.7	50.3
	11.8	9.0	4.5	8.3	9.3	5.0	9.3	7.3	5.5
Spec. density	1.004	1.024	1.044	1.020	1.032	1.052	1.010	1.020	1.040
	0.007	0.007	0.006	0.007	0.004	0.003	0.009	0.011	0.004
percent of fat	35.8	28.9	21.0	30.5	25.7	18.0	34.6	30.5	22.6
	2.8	2.8	2.3	2.8	1.6	1.1	3.6	4.4	1.6

TABLE 2

Boys	1st year			2nd year			3rd year		
	treatment in the camp		normal values	treatment in the camp		normal values	treatment in the camp		normal values
	before	after		before	after		before	after	
height	150.9	150.9	143.0	155.6	156.6	148.0	161.2	162.5	155.0
weight	5.3	6.3	6.8	5.9	5.8	6.6	7.0	4.4	8.5
	65.8	57.7	35.8	69.8	63.6	39.3	79.1	70.3	44.2
	8.5	7.6	3.5	10.3	8.4	4.6	9.1	7.7	5.2
body density	1.003	1.024	1.042	1.013	1.028	1.044	1.010	1.025	1.052
	0.010	0.010	0.005	0.013	0.010	0.006	0.017	0.022	0.004
percent of fat	37.5	28.9	21.8	33.4	27.3	21.0	34.6	28.5	18.0
	4.0	4.0	1.9	5.2	4.0	2.3	5.8	8.8	1.6

therefore, cannot exclude that these changes, were also caused by a loss of body fluids; this will have to be verified still by additional examinations.

The increases during the year when obese children kept coming for regular controls to the outpatient department meant, in spite of every advisory

care, a considerable increase of fat. The active mass also developed, but it formed, on the average, only a small proportion of the overall increase in weight, as is illustrated in Fig. 2. (The active mass increase, however, was the same in its absolute values as in normal children. This means that, in comparison

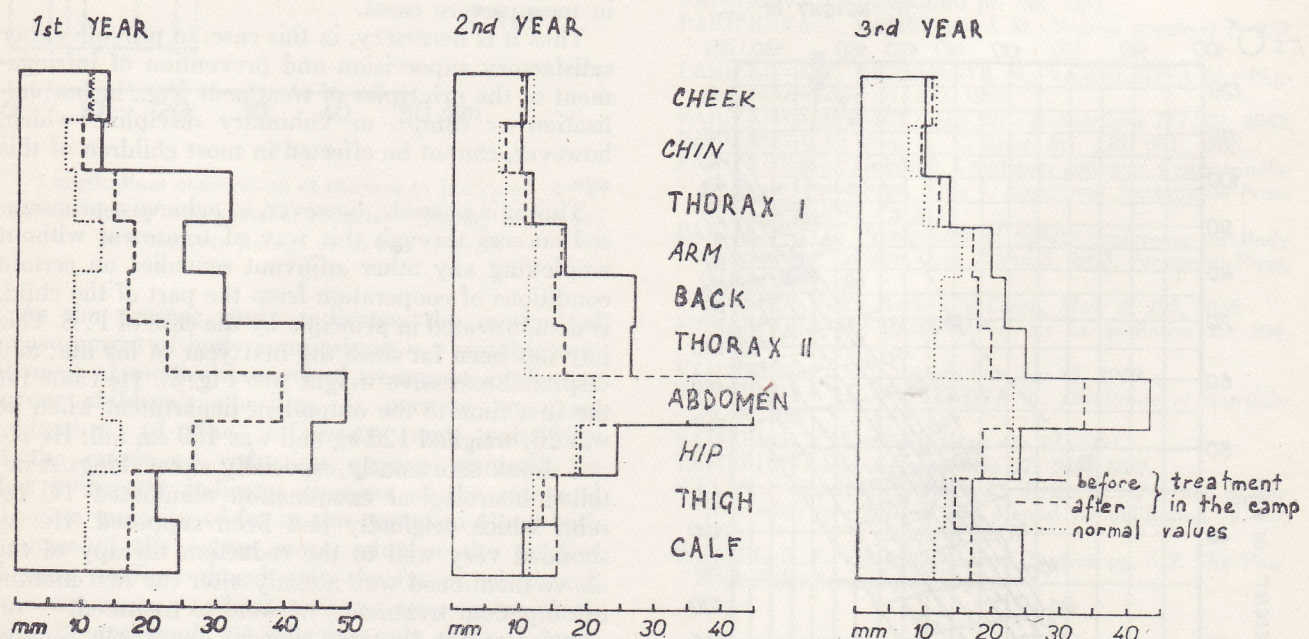


FIG. 3

Changes in thickness of skinfolds in obese girls

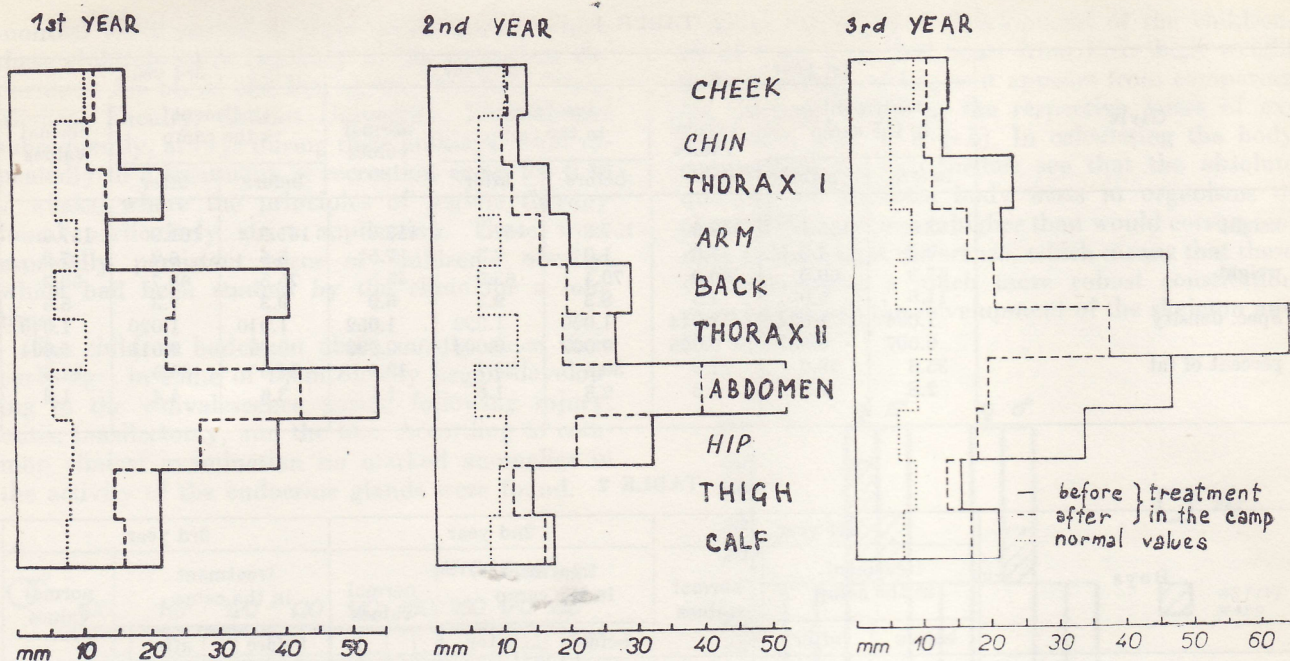


FIG. 4  
Changes in thickness of skin folds in obese boys

with the results of the treatment camps an advisory treatment of obesity in such particularly persistent cases is very poorly effective and hinders the further development of obesity only to a small extent.

Subcutaneous fat, too, responds markedly to reduction treatment; as Figs. 3 and 4 show, a significant decrease in the skinfold thicknesses in every spot of the body surface occurs following every stay in the treatment camp. The subcutaneous fat, just as the overall fat, however, begins to grow in the course

of a year of advisory treatment, and the thickness of skinfold thicknesses increases as well.

On comparing the percentage of fat preceding and following the treatment in a centre over the first and the third year, we may observe that the mean values remain the same both before and after the stay in the centre. As a matter of fact, the treatment in centres always brings about a great improvement, but the return home, which means an interference with the following of the principles in reduction therapy, soon causes a return to the original state; from this follows that advisory care is unsatisfactory in more severe cases.

Thus it is necessary, in this case, to provide either satisfactory supervision and prevention of infringement of the principles of treatment (e.g., in hospitalisation or camp), or voluntary discipline which, however, cannot be effected in most children of this age.

That it is possible, however, to achieve a pronounced success through this way of treatment without employing any other adjuvant remedies on certain conditions of cooperation from the part of the child, is demonstrated in principle by the case of F. S. This boy has been fat since the first year of his life; and displaced excessive weight (see Fig. 5). He came for the first time to the outpatient department when he was 15, weighed 126 kg and was 169 cm tall. He ate and drank enormously, especially sweet things. A detailed neurological examination eliminated TU cerebri which originally had been supposed. He responded very well to the reduction therapy of the above mentioned way already after the first months of outpatient treatment; he went to treatment — recreation camps for three times in the whole. Similar to the other children the highest fat reduction always occurred in these centres, but on the other hand, he

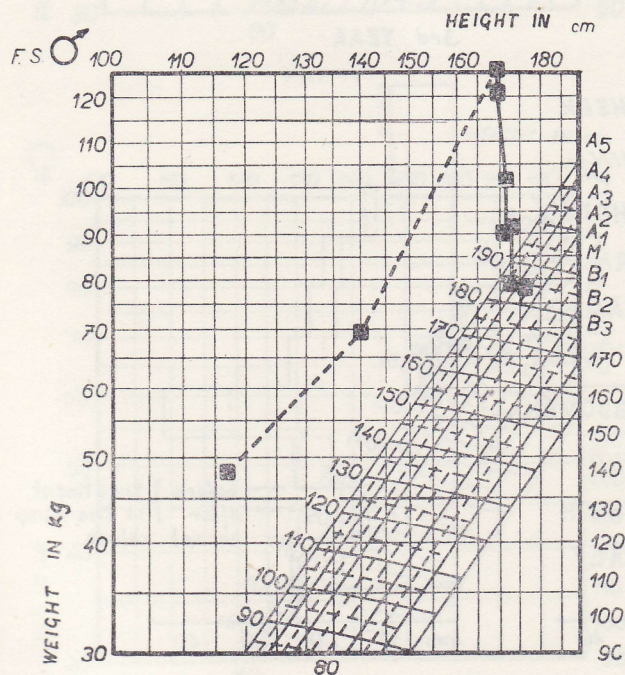


FIG. 5

did not succeed in raising his weight too much during the year, but in lowering it actually: Fig. 5 shows the changes of height and weight in Wetzels grid system, as can be seen, normalization almost set in. The overall percentage of fat decreased strikingly like the thickness of the layers of subcutaneous fat measured by calipers, as indicates in the following Figs 6 and 7. However, it is necessary to emphasize that this boy — who was also older than the above mentioned children — had cooperated very well from the beginning, had himself been much interested in reduction, and therefore observed a strong diet, both quantitatively and qualitatively, had much gone in for physical training, etc. A control of the efficiency of cure by means of determining the changes in the proportions of the lean body mass and the fat in the course of treatment indicates that, in this way, no greater impairment occurs, and that, therefore, it is very suitable for children.

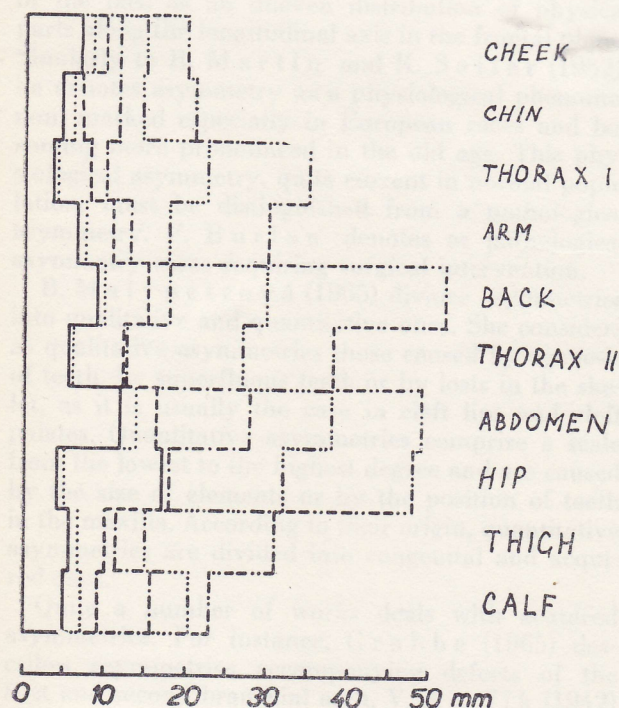


FIG. 6

Longitudinal observation of changes in thickness of skinfolds during two years of reduction therapy in the boy F. S. between the age of 15 and 17 years

As the present study indicates, the method of measurement of body composition is a suitable supplement of medical control of treatment applied to severe children's obesities. It permits an exact evaluation of the efficiency and suitability of the employed reduction process primarily in that it directly indicates changes of the rate and absolute quantity of fat in the organism along with changes of the active mass, whether the applied therapy, really reduced only the fat or whether it does not cause a reduction of the active mass. A similar control could be effective only through long-term observation of the child during hospitalization and detailed study of the nitrogen balance which is

essentially a much more complicated affair. Thus the anthropometric method helps in a quicker and more accessible way to make both a more correct diagnosis and to perform an easier and sufficiently reliable evaluation of the effect of treatment.

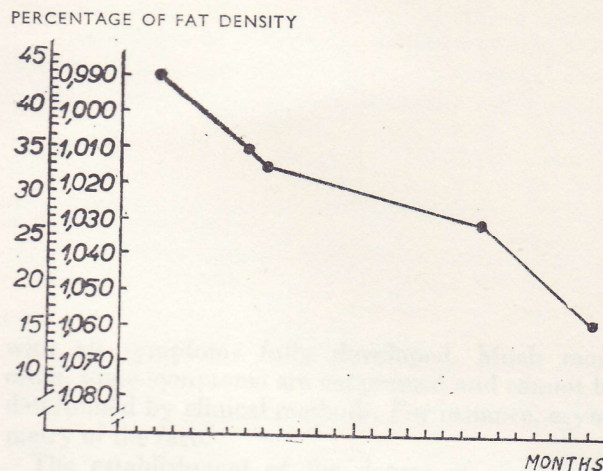


FIG. 7

Change of overall percentage of fat following reduction therapy in the boy F. S. between 15 and 17 years

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