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Changes in Body Composition and Serum Lipid Fractions After Four Weeks of Slimming Treatment: Results in Nineteen Obese Male Adolescents

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The changes in body composition and in serum levels of total cholesterol (T-chol), triglycerides (TG), high density lipoprotein cholesterol (HDL-C), very low plus low density lipoprotein cholesterol (VLDL + + LDL-C), the ratio T-chol/HDL-C and non esterified fatty acid (NEFA) were studied in nineteen obese male adolescents after 28 days of slimming treatment which consisted in hypoenergetic diet and exercise. Relative fat body weight (%BF) was calculated by Parizková and Roth's regression equations for five fatfolds and lean body weight was obtained as the difference between body weight and fat body weight.

Significant reductions in %BF, T-chol and T-chol/HDL-C ratio were found. The decrease in TG was not significant but had a better correlation with the reduction of adiposity (Δ%BF) than the previously mentioned two variables. The increase of lipolysis during the four weeks of study is expressed in the significant rise of NEFA and its correlation ($r = -0.714$) with Δ%BF. A tendency to increase in HDL-C could be observed, and a significant inverse correlation ($r = -.804$) with Δ%BF was found.

The results obtained showed that the combination of diet and exercise for treating obesity in adolescents influences favourably the risk factors of ischaemic heart disease related to serum lipid and lipoprotein profiles and does not significantly affect lean body mass, at least up to four weeks.

The association between obesity and high risk of ischaemic heart disease seems to be determined by the common occurrence of high serum lipid concentrations [13, 20]. An inverse highly significant correlaton between high density lipoprotein cholesterol (HDL-C) and triglycerides (TG) in serum, and between HDL-C and very low density lipoprotein cholesterol (VLDL-C) has been found, while obesity is also inversely correlated with HDL-C and directly correlated with TG [2, 9, 14, 18, 23].

Fasting [39] or a very low energy diet [34, 37, 41, 42] for achieving a rapid body weight reduction has been reported to produce a decrease in total serum cholesterol (T-chol), TG and low density lipoprotein cholesterol (LDL-C). Still, the attempts to correlate body composition and its changes with the variations of diverse serum lipid and lipoprotein fraction yielded contradictory results [21, 22, 26, 27, 35].

The present paper had the aim to clarify the above problem by studying

TABLE I

Individual figures for age, stature, age at onset of obesity, and initial and final values for body weight and relative fatness in 19 adolescents

No	Decimal Age	Age at onset of obesity	Stature cm	Body weight, kg		Relative fatness, per cent	
				Initial	Final	Initial	Final
01	13.2	8.5	153.4	60.5	54.2	30.0	24.9
02	12.7	9.0	149.2	86.9	80.8	35.0	33.4
03	11.4	9.5	143.4	52.4	45.3	32.6	27.1
04	12.5	7.0	143.9	50.7	46.5	32.3	27.5
05	12.2	9.5	148.8	65.2	61.6	32.8	30.0
06	13.4	11.0	158.3	108.0	99.9	43.1	40.7
07	12.0	10.5	141.5	61.9	57.0	34.4	31.3
08	13.1	10.5	155.0	77.9	71.4	35.3	32.7
09	11.9	6.5	154.1	79.3	73.9	36.1	32.6
10	12.8	9.5	156.5	99.7	92.8	35.4	32.3
11	12.5	6.5	148.9	60.8	53.5	37.6	30.5
12	11.7	8.5	134.1	46.6	37.9	36.6	29.0
13	12.0	7.5	145.6	58.2	49.2	30.6	22.9
14	11.7	8.0	135.5	48.5	42.4	33.2	25.7
15	11.4	7.0	139.6	43.4	35.6	34.1	27.2
16	11.2	8.0	143.8	62.2	52.5	36.0	30.8
17	11.3	7.0	136.3	51.9	45.5	36.2	30.7
18	12.8	7.5	155.8	63.6	56.1	41.5	35.4
19	13.2	7.0	150.0	66.9	51.9	40.8	30.8

obese male adolescents after four weeks of hypoenergetic diet combined with systematic physical activity.

SUBJECTS AND METHODS

Sample selection. Nineteen male obese adolescents aged 10—14 years with moderate overfatness (relative fat body weight between 30 and 45%) were studied. All of them exhibited a body weight for stature above the 97th percentile [11], and a triceps fatfold above the 90th percentile [19]. The patients were selected among those showing no endocrine or metabolic disease, reporting for the first time at the outpatient clinic, without any previous treatment for weight reduction.

Methods of study. Patients were admitted to the Service of Clinical Nutrition at the William Soler Paediatric Hospital, and an anthropometric assessment of the nutritional status was carried out. This comprised the following measurements: body weight (BW), stature (HT), fatfolds (triceps, T; biceps, B; subscapular, SS; suprailiac, Sl and calf, C), and mid-arm circumference (MAC). Measurements were made according to the International Biologic Programme [40], except for Sl in which case Parízková's method [31] was followed. After twelve hours of fasting, venous blood samples were obtained from each subject for biochemical studies.

Treatment started inmediately thereafter, and consisted in a hypoenergetic diet (0.18 MJ/kg of expected BW for stature) with 45% carbohydrate, 35% fats and 20% proteins. A systematic program of exercise comprising gymnastics and jogging with progressive loads complemented the dietary treatment. All children received individual and collective psychological support.

Anthropometric and biochemical assessments were repeated after 28 days of treatment.

Anthropometric indices studied were:

Relative fat body weight (%BF), according to Parízková and Roth's [32] re-

gression equations for five fatfolds, on the left side of the body.

Fat body weight (FBW) was calculated from BW and %BF as follows

$$FBW = \frac{\%BF \times BW}{100}$$

Lean body weight (LBW) was obtained as the difference of BW and FBW.

Biochemical variables studied were:

Total serum cholesterol (T-Chol), according to Pearson [33]. HDL-C, according to Burstein, modified by López Virella [7]. The T-Chol/HDL-C ratio. LDL + VLDL-C according to Burstein and Samaille [8]. TG according to Grafnetter et al [15]. Non esterified fatty acids (NEFA) according to Duncombe [10].

Statistical evaluation: Means comparison by Student's *t* test, previous variance analysis by Fisher's test, correlation studies between changes in %BF and changes of lipid fractions.

Results

Table I shows the individual figures for age, stature, age at onset of obesity and initial and final values for body weight and relative fatness.

Figure 1 shows the changes in the individual values of %BF and LBW in each subject studied. While the differences for the first index between initial and final values were significant, they were not significant for the second one.

Figures 2 and 3 show the variations of the six biochemical variables in each one of the 19 obese adolescents after 28 days of treatment. Differences were only significant for T-Chol, T-Chol/HDL-C ratio and NEFA.

In Table II, the results of the correlation studies between the reduction of relative fatness (Δ%BF) and the changes occurring in six biochemical variabes at the end of the period of study, are shown. Significant correlations were evident with ΔTG, ΔHDL-C and ΔNEFA.

Discussion

The significant reduction of the degree of adiposity and that of T-Chol, without a significant decrease in LBW,

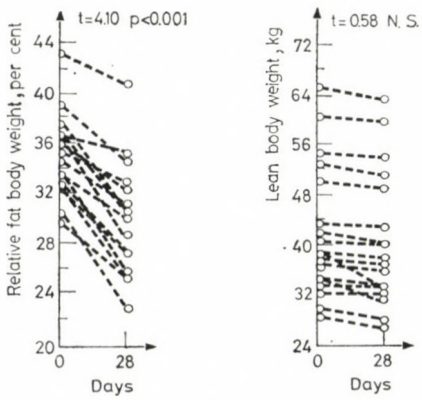

Fig. 1. Individual values of relative fatness and lean body weight in 19 obese male adolescents. The modification in body composition occurred mainly in adiposity; the fat-free mass remained almost unchanged

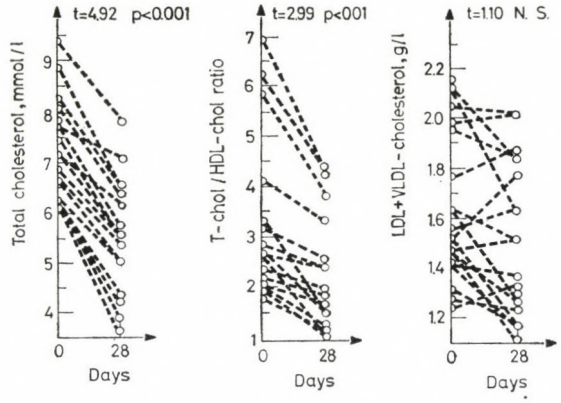

FIG. 2. Total serum cholesterol, total cholesterol/HDL-cholesterol ratio and LDL + + VLDL cholesterol after four weeks of slimming treatment. Differences were significant in the first and second variables

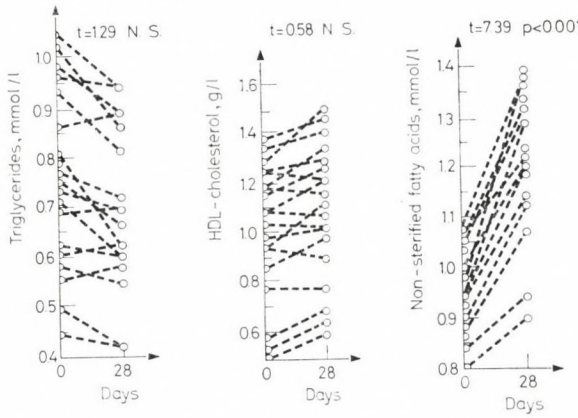

FIG. 3. Serum triglycerides, HDL-cholesterol and non-esterified fatty acids, after four weeks of slimming treatment. Differences were significant only for NEFA. In HDL, the general tendency was to increase, except a slight decrease in five subjects

showed the favourable effect of the hypoenergetic diet with a program of systematic physical exercise.

It was remarkable to find a highly significant correlation between the reduction of relative fatness and the variations in serum concentrations of TG and HDL-C. Follick et al [13] found a highly significant correlation between weight loss and subsequent HDL increase.

In previous studies, an early reduction of TG levels due to slimming treatment has been described [3, 16, 34], but other authors did not observe such an effect [12, 42]. Nevertheless, it seems evident and our results pointed to that direction that a correspondence exists between the reduction of fatness and the decrease of serum TG levels, the latter decreasing more slowly than the T-Chol concentration.

TABLE II

Correlation between relative fat vody weight reduction (⊿%bf) and the changes in several lipid fractions after four weeks of slimming treatment in 19 obese adolescents

Correlations	Regression line			
	a	b	r	p
⊿%BF and ⊿T-chol	—1.41	0.05	0.208	n.s.
⊿%BF and ⊿T-chol/HDL-C	—0.33	0.10	0.314	n.s.
⊿%BF and ⊿TG	0.15	0.04	0.927	<0.001
⊿%BF and ⊿HDL-C	0.21	—0.03	—0.804	<0.001
⊿%BF and ⊿VLDL+LDL-C	0.14	0.003	0.194	n.s.
⊿%BF and ⊿NEFA	0.13	—0.02	—0.714	<0.001

⊿ T-col = changes in total serum cholesterol
⊿ T-col (HDL-C = changes in the ratio total serum cholesterol) HDL-cholesterol
⊿ TG = Changes in serum triglycerides
⊿ HDL-C = Changes in serum high density lipoprotein cholesterol
⊿ VLDL + LDL-C = Changes in serum very low density plus low density lipoprotein cholesterol
⊿ NEFA = Changes in serum NEFA

The effect of adiposity reduction was also reflected in the slow but progressive increase of serum HDL-C concentration, and in significant inverse correlation with the reduction of relative fatness. The ratio T-Chol/ /HDL-C decreased significantly, but its correlation was not as high as the augmentation of HDL-C.

The degree of contribution of the hypoenergetic diet on the one hand and exercise on the other hand was not easy to consider separately; probably they interacted reciprocally [4, 38]. In our patients, though a quantitative reduction in intake was made, there was no qualitative change in the composition of the diet, a fact necessarily to be taken into account when assessing a slimming treatment 38].

Everything points to the fact that the effect of a given diet is closely related to its duration, more than to the severity of restriction. A short fast does not modify significantly the serum concentrations of T-Chol and HDL-C [27, 28, 39]. On the other side, there are many reports describing the increase of serum HDL-C and Apo-A concentrations, and the reduction of TG, LDL-C and Apo-B as results of systematic physical activity [17, 24, 25] or following a hypoenergetic diet [1], though there are also reports which indicate that HDL-C levels fall during active weight loss [6, 36]. Bialowska et al [3] found after a low calorie diet a decrease in serum TG, T-Chol and Apo-B but no changes in HDL-C.

The significant increase in NEFA serum levels and its high correlation with the decrease of adiposity seems to be related to an increase of lipolysis during the time of study. Molnár and Soltész [28] observed that the increase of NEFA in obese children after

fasting was not significant like in normal children, a fact that suggested an impaired lipolysis in overfat children. They also found a negative correlation between fasting NEFA and adiposity [27]. According to our results, lipolysis did not seem to be impaired in our patients.

As some sexual hormones may influence lipid metabolism [29, 30] it is necessary, especially during adolescence, to study each sex separately. That is the reason why we have chosen only males for the present study.

Though the material was rather homogeneous regarding the degree of overfatness and pubertal development, the response to treatment was not identical, neither were the changes in the lipid fractions of the same intensity and in the same direction, regardless of the onset of obesity occurring in all cases during the prepubertal years. This was in accordance with the increasing number of observations which point to the fact that obese people do not form a homogeneous group [5, 38]. A more detailed study including the grouping of obese subjects according to their response to treatment, will greatly contribute to a better understanding and evaluation of the results of a given scheme of treatment.

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