

# Blood Lipid Levels as Influenced by Weight Reduction in Men

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**I**N AN earlier paper observations were reported on blood lipid levels in twenty-four women while losing 15 to 60 pounds of weight at the rate of from 0.6 to 2 pounds per week; similar blood lipid data for twelve women who did not lose weight were also presented. The data as a whole revealed the rather wide fluctuations in blood lipids which occur in women whether losing weight under dietary control or changing little in weight with no dietary control. No detectable linear relation between weight change and level of total serum lipids within individuals was found. A small but significant overall linear relation within individuals was noted between weight loss and serum phospholipids, and between weight loss and serum cholesterol.<sup>1</sup>

## METHODS

The study presented here deals with repeated observations on blood lipid values for twenty-four men from 10 to 96 per cent overweight, all of whom lost weight. The "per cent overweight" was calculated by the formula of Showacre, which uses height-chest diameter ratios to complement standard height-body build-weight tables.<sup>2</sup> Twelve men were under rigid dietary control for a period of nine weeks. These men ate all their

meals at a diet table operated by the research team. One investigator supervised menus and a weekly weigh-in period. Fasting blood samples for lipids were taken at the beginning and end of each three-week period and weekly while the subjects were on a diet of 50 g of fat per day; also, samples were taken weekly during the three-week period after the fat in the diet had been restored to 103 g per day. The remaining 12 men, not under rigid dietary control, were observed from 11 to 24 weeks (average 15.5 weeks).

Group I consisted of twelve men who were observed in a nutrition clinic sponsored jointly by the local medical society, the county health department, and the School of Nutrition. The prescribed caloric intake of this group was 1400 calories, with a daily intake of 80 g fat. The ages in this group varied from 31 to 68 years, with an average age of 42 years. Members of Group I lost from 7 to 42 pounds each over a period varying from 11 to 23 weeks at a rate of loss of from 0.5 to 1.8 pounds per week.

Group II was composed of twelve men who were on a carefully controlled weight reduction program over a period of nine weeks, during which time the fat content of the diet was 103 g per day for the first and last three-week periods, and 50 g per day during the middle three-week interval. The ages in this group varied from 19 to 28 years, the average being 22 years. This group lost from 13.5 to 31.5 pounds each over the nine-week period, at a rate of loss varying from 1.5 to 3.5 pounds per week.

The data for total lipids presented here represent the combined total fatty acids and cholesterol as determined by the method of Bloor.<sup>3</sup> The phospholipids were obtained by determining phosphorus in the lipid extract

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TABLE I  
Serum Lipid Values in Twenty-four Men who Lost Weight

% Overweight	Rt. of wt. loss lb/wk	Total Lipids mg/100 ml				Phospholipids mg/100 ml				Cholesterol mg/100 ml			
		Initial	Term.	High	Low	Initial	Term.	High	Low	Initial	Term.	High	Low
63	1.83	712	474	712	474	270	207	270	207	180	148	185	148
47	1.54	684	615	684	615	260	242	260	242	200	203	234	200
20	1.50	615	455	615	455	255	212	255	208	235	172	235	172
20	1.40	740	460	740	460	258	192	258	192	216	168	216	168
45	1.36	687	588	687	588	304	215	304	215	211	182	211	172
47	1.27	730	625	730	625	230	222	247	222	204	205	227	203
29	1.14	522	680	680	522	242	254	275	242	196	211	211	196
20	0.92	544	592	665	544	222	255	255	222	220	240	240	210
96	0.88	995	719	995	719	336	264	336	264	259	220	259	220
45	0.85	625	635	635	480	210	228	228	195	190	184	190	174
45	0.78	825	685	825	662	300	258	300	215	246	237	246	221
19	0.47	692	782	782	563	302	324	324	277	251	234	251	209
Group II													
48	3.50	642	830	888	608	286	283	286	196	232	240	251	185
12	3.22	491	680	820	491	200	252	262	198	154	204	250	154
27	2.91	751	590	751	562	286	230	286	199	269	187	269	149
31	2.86	622	695	755	595	234	214	290	206	209	190	212	184
15	2.83	566	525	730	450	224	221	224	166	178	152	196	142
25	2.80	610	690	835	610	257	226	262	216	209	200	209	167
23	2.63	661	750	860	625	260	243	264	215	225	200	261	195
22	2.52	520	530	670	488	223	168	223	155	164	132	180	127
22	2.22	490	403	670	403	196	164	207	163	155	117	155	117
18	2.19	677	659	860	612	238	206	238	183	215	174	215	157
20	2.16	528	522	765	500	230	198	230	186	181	167	193	144
10	1.50	618	795	865	618	304	307	307	228	223	276	276	215

by the method of Sumner.<sup>4</sup> The total cholesterol was obtained by the method of Sperry and Webb.<sup>5</sup>

### RESULTS

In Table I, the initial and terminal values of serum total lipids, serum phospholipids, and serum cholesterol are given for both groups of men while losing weight. The data also show the high and low values during the observation period for each of the serum lipids.

Of the twelve subjects in Group I, four had terminal serum total lipid values higher and eight lower than initial values. Of the nine subjects having initial-terminal differences greater than 10 per cent, two had higher (and seven had lower) terminal serum total lipid values. Serum total lipid values between the initial and terminal levels in this group showed wide fluctuation from their means. A regression analysis\* of serum total lipids on weight in this group shows a "within subjects" regression coefficient of 5.50, or a decrease of 5.5 mg serum total lipids per 100 ml serum per pound of body weight lost. This is significant at the 1 per cent level (Table II).

The men in Group II showed serum total lipid values different from the men in Group I. In Group II, seven subjects had higher (and five subjects had lower) terminal serum total lipid values. Eight subjects had initial-terminal differences greater than 10 per cent; of these, six had higher and two had lower terminal serum total lipid values. No relationship was found between the rate of weight loss and the degree of change of initial-terminal values. The "within individuals" regression coefficient of serum total lipids on weight of Group II was 3.98, or an increase of 3.98 mg serum total lipids per 100 ml serum per pound of weight lost. This is significant at the 1 per cent level.

#### Phospholipids

Of the twelve subjects in Group I, four had higher and eight had lower terminals than

\*The authors are indebted to Dr. R. G. D. Steel of the Biometrics Unit, Department of Plant Breeding, for statistical analysis of total lipids, phospholipid, and cholesterol data.

TABLE II

Regression Coefficients of Components on Weights of 24 Women Losing Weight<sup>1</sup> and 24 Men Losing Weight

Component	Women (N = 24)	Men (N = 24)	
		Group I (N = 12)	Group II (N = 12)
Total lipids	0.33	5.5†	-3.98†
Phospholipids	-0.64*	1.77†	0.58
Cholesterol	-0.58*	0.89†	0.24

\* Significant at 5% level.

† Significant at 1% level.

initial serum phospholipid values. Of the seven subjects having differences greater than 10 per cent, only one had a higher terminal phospholipid serum level, while six had lower terminal serum values. Rate of weight loss was not a factor in the initial and terminal serum phospholipid values. (Table I).

Regression analysis shows that the "within individuals" regression coefficient was 1.77, or a decrease of 1.77 mg phospholipids per 100 ml serum per pound of weight lost, and was significant at the 1 per cent level (Table II).

Of the 12 subjects in Group II, two had higher but ten had lower terminal serum phospholipid levels. Of those having initial-terminal differences greater than 10 per cent, one showed a higher and six showed lower terminal values. Group II followed the same pattern as Group I in regard to the number and direction of those with differences greater than 10 per cent in initial and terminal values. The "within individuals" regression coefficient for this group was 0.58, or a decrease of 0.58 mg phospholipids per 100 ml serum per pound of body weight lost. However, the regression coefficient was not significant.

#### Cholesterol

In Group I, there were four subjects who showed higher and eight who showed lower terminal serum cholesterol levels. However, there were but five men who had initial-terminal differences of 10 per cent or more, and all of these had lower terminal serum cholesterol values. Regression analysis shows a "within individuals" regression coefficient of 0.89 (significant at the 1 per cent level) or a decrease of 0.89 mg cholesterol per 100 ml serum per pound of weight lost.

In Group II, three subjects showed higher, while nine showed lower, serum cholesterol terminal levels over initial values. In the eight men showing differences of more than 10 per cent, two had higher and six had lower terminal serum cholesterol values.

If both Groups I and II are considered together, there were two with higher but eleven with lower terminal serum cholesterol values among the thirteen subjects who had initial-terminal serum cholesterol level differences above 10 per cent. A regression analysis of Group II shows a "within subjects" regression coefficient of 0.24 (not significant), or a decrease of 0.24 mg cholesterol per 100 ml serum per pound of body weight lost.

#### DISCUSSION

Physiologically, the two groups of twelve males each in this study differed in average age, duration of the reduction period, in rate of loss of weight and the amount of fat in the diet. Both groups were "healthy," no one in either group showing symptoms or signs of disease. The groups differed statistically in the following ways: Linear regression coefficients showed statistical differences in the two groups. Whereas the regression analysis in Group I, the older men, showed a 5.5 mg decrease in serum total lipids per 100 ml serum per pound of body weight lost, that for Group II, the younger men, was a 3.98 mg increase in total lipids per 100 ml serum per pound of weight lost.

For phospholipids, the regression coefficient for Group I was significant at the 1 per cent level. This was not true for Group II. No valid comparison of regression coefficients for cholesterol can be made because of the non-homogeneity of regression coefficients in either group.

It is apparent, therefore, from the physiologic and statistical differences of the two groups, that data from each group cannot be pooled and the totals compared with data obtained by us from women who lost weight. The two groups of men had different patterns of total lipid, serum phospholipid, and cholesterol behavior during weight loss than were

observed in women. The data for Table II indicate there is no detectable linear relation between weight change and level of serum total lipids within individuals for women, whereas a linear relationship is indicated for men. Although linear relationships between weight change and blood phospholipid and cholesterol levels are shown in Table II for both men and women, the regression coefficients are in opposite directions for each sex, respectively, during weight loss.

While the study includes comparatively few subjects, and while there seem to be certain linear relationships shown, the question remains:—*Is the relationship between the level of blood lipids and weight loss of physiologic importance?* In the case of phospholipids and cholesterol for both men and women, the answer would appear to be no—for wide fluctuations in these values have been observed in normal people both losing and not losing weight. In the average overweight person, loss of all excess weight through dieting would not change blood lipid values to the extent they would exceed the variations in these lipids occurring in the serum of people of normal weight.

In Group II, the wide fluctuations in blood lipids appear to be partly related to the content of fat in the diet, for in every subject the lowest levels of serum lipids were obtained at the end of a three-week period when the fat content of the diet had been lowered from 103 to 50 g daily. In Figure 1, the mean blood lipid values and weight curve of the twelve men in Group II are shown. Two weeks following reduction of fat in the diet, the level of all blood lipids which were measured started to fall and were lowest at the end of the low fat period one week later. After one week on an uncontrolled diet, the curves again rose. The slope of the weight curve during this time remained constant. This observation is in line with that previously reported in the literature.

The rather high regression coefficient for total lipids in opposite directions for the older and younger male groups, respectively, would appear to be of questionable conse-

quence. That wide fluctuations occur in serum total lipids in people of constant weight is well known; therefore, a similar reaction in men losing weight appears not to be of physiologic importance.<sup>1,6</sup>

wide fluctuation in blood lipids which occurs in men losing weight.

The data from the two groups could not be pooled and compared with similar data from women losing weight because of the physio-

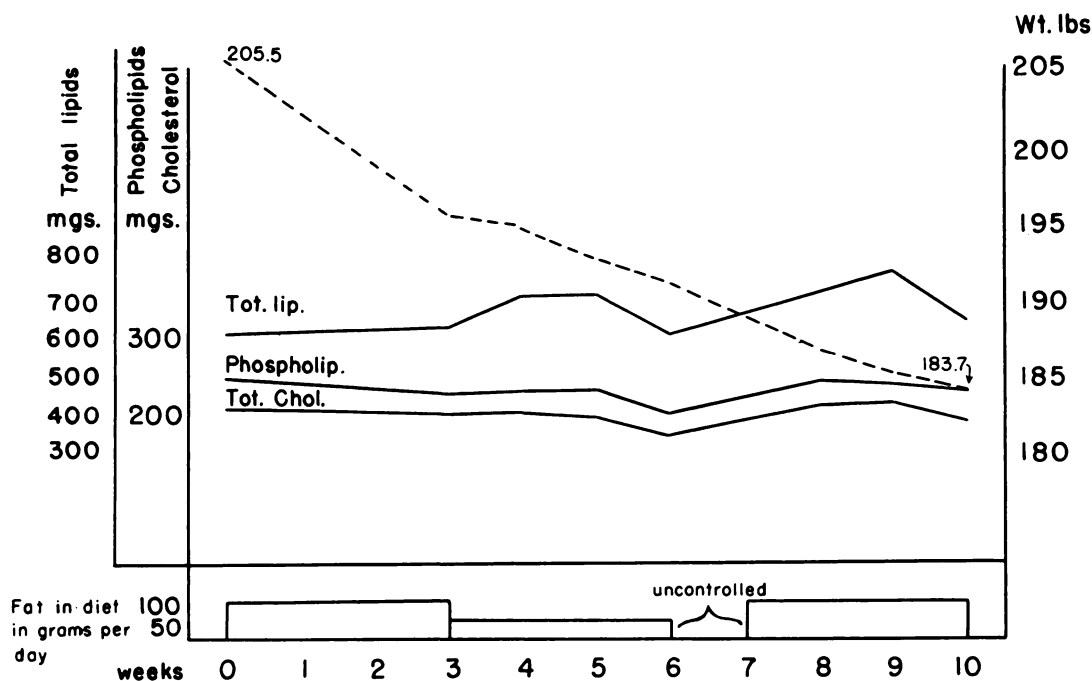


Fig. 1

Group II

Mean blood lipid values of 12 men on controlled diet.

Amount of fat in diet during each period and mean weight loss values.

#### SUMMARY

Blood lipid data are presented for twenty-four men while losing from 0.5 to 3.5 lb body weight per week. Twelve of these individuals, Group I, ranged from 31 to 68 years of age (average age 42 years); twelve other men, Group II, ranged from 19 to 28 years of age (average age 22 years).

The men in Group I were not under rigid dietary control, but had diets prescribed for them which contained 80 g of fat per day. The subjects in Group II were under rigid dietary control. Their daily intake of fat was 103 g for the initial and terminal three weeks' periods and 50 g of fat daily during the middle three weeks' period.

The data as a whole revealed the rather

logic and statistical differences of the groups. However, both Groups I and II showed different regression coefficients for blood lipids than did women losing weight, i.e., women showed a small increase in serum phospholipid and cholesterol per pound of weight lost, but both groups of men showed decreases with weight loss. While in the women there was no detectable linear relationship between weight change and serum total lipids (within individuals), in both groups of the men there were highly significant linear relationships. In the older men there was a decrease and in the younger men an increase in serum total lipids with weight loss.

Even though regression analyses establish regression coefficients for men losing weight

which are different from those for women losing weight, the resulting changes in the level of serum lipids appear to be of no physiologic importance.

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### **Old Men and Their Food**

"It is rarely . . . that one comes across a contribution at once so informative, interesting and even amusing, as the recent report by the Senior Almoner of the Belfast City Hospital on elderly men in common lodgings, published by the Nuffield Provincial Hospitals Trust. This deals with nearly four hundred men in some sixteen lodging houses scattered all over Belfast. . . .

"Many of the old men, as might be expected, had arrived at very decided if somewhat bizarre views on the subject of diet. 'The elderly man who remarked spryly: 'We ould fellas don't have the same use for food now,' summed up this situation very well. One particularly rubicund old gentleman attributed his good health to cod-liver oil which he spread on bread instead of butter and washed down with spring water specially carried down by himself in bottles from the upper reaches of the River Lagan. Another was a firm believer in cabbages and herrings which he always ate together and which he bought in large quantities and stored happily in his locker from one pension day to the next. A wizened-faced old man was scornful of sausages and referred to them as "those mysteries," a view which was held by most of his fellow lodgers; while a seedy, taciturn old man with no socks or dentures, announced that tinned soup, bread, tea and fries were his main dishes, though he confessed that his mother had taught him how to make "pies and puddens." These four items plus an occasional helping of potatoes, porridge and broth, constituted the main items of diet for those elderly men who took the trouble to cook. . . . The broth gang has already been mentioned and is the answer either for the inexperienced cook or the old man who cannot be bothered to make a proper meal for himself. Each member of the gang contributes an offering to the pot and it was surprising the number of old men who have contacts in the market or who are "in the way of getting" the old carrot, turnip or onion. In this manner a large pot of broth can be made by the acknowledged expert and is ladled out to serve as dinners for several days.'"

—*The Medical Press* 232: 326, 1954.

