Ultracentrifugal Studies of Lipoproteins in Diabetic Sera*

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Previous reports by Gofman and associates[1-4] have indicated that a higher level of the ultracentrifugal S_f 12-20 fraction of serum lipoproteins is to be found in diabetic than in normal individuals. These data were obtained from populations of diabetic individuals which were not relatively homogeneous. They are also based upon the principle of computing the percentage of diabetics with values of S_f 12-20 below an arbitrary level. The method tends to obscure the fact that some diabetics exhibit very low concentrations as well as very high concentrations.

We have compared with normal individuals the more homogeneous groups of cooperating diabetics, uncooperating diabetics, and diabetics with some form of cardiovascular-renal disease. The data were treated so that the mean value of all the concentrations of S_f 12-20, both low and high for any group, would be considered.

The normal group consisted of 310 males between the ages of 26 and 60. All had blood pressures below 140 systolic and 90 diastolic; all electrocardiograms (made on nine-tenths of the individuals) proved to be normal. None had a history of diabetes, cardiovascular-renal disease or nephritis. Urinalysis showed absence of albumin and sugar. The cooperating diabetics, numbering 88 males, showed no evidence of cardiovascular-renal disease, were taking insulin as prescribed, had had diabetes for varying lengths of time, were on diets containing between 60 and 100 grams of fat each day and were judged to be good cooperators by their physicians.

The uncooperating diabetics, numbering 40 males, had no evidence of cardiovascular-renal disease but composed a somewhat heterogeneous group. They consisted of new patients, information about whose insulin and dietary intake was not accessible for evaluation, and patients whose physicians described them as poor cooperators. The cardiovascular-renal group, numbering 39 males, were diabetics who had had myocardial infarction, angina pectoris and hypertension in all possible combinations.

Carefully excluded from all groups were individuals

* Publication No. 16 of the Department of Biophysics.

diagnosed as having thyroid abnormalities, xanthelasma, alcoholism and other diseases known possibly to cause abnormal fat metabolism or for which medication might cause abnormal fat metabolism. Cases of Kimmelstiel-Wilson syndrome and epilepsy were also excluded.

Table I illustrates the mean values of S_f 12-20 lipoproteins for normal males in age groups from the third to sixth decades.

TABLE 1 S_f 12-20 Lipoproteins in Normal Males

	Age 21-30	Age 31-40	Age 41-50	Age 51-60
Number	76	131	78	25
Mean	36.4	39.5	46.2	35.8

Total Number	310
Mean of Means	40.1
Standard Deviation	22.1
Correlation coefficient (r)	.088, not significant .07
Correlation ratio squared (E^2)	.029, not significant .02

It may be seen that the mean of means for the 4 age groups is 40.1 mg. per cent which agrees very well with the findings of Jones, Gofman, et al[5] who found the mean concentration of S_f 12-20 lipoproteins to be 40 mg. per cent from 28 to 55 years.

It is noticeable that the fluctuation in our group means is greater than theirs, probably because of our use of smaller numbers. Our group means vary from 36.4 to 46.2 mg. per cent. However, the correlation coefficient of .088 means that there are more than 7 chances in 100 that there is no linear correlation between S_f 12-20 lipoproteins and the age groups. The correlation ratio squared, indicates that there are more than 2 chances in 100 that there is no association of any kind between S_f 12-20 and these age groups. Therefore, it becomes justifiable to combine the means of all the groups into a mean of means, 40.1 mg. per cent for comparison with the different groups of diabetics.

Table 2 gives a comparison of the lipoprotein values in the male groups of cooperating diabetics, cardiovascular-renal diabetics, and uncooperating diabetics from 26 to 85 years. The group of cooperating diabetics, numbering 88 individuals, was sufficiently large to be broken down into a 26-60 year sub-group and a 61 to 85 year sub-group. Since the means and standard deviations of the sub-groups remained unchanged, these diabetics may be compared with the normals of 21 to 60 years and with each other.

TABLE 2 S_f 12-20 Lipoprotein in Diabetic Males 26 to 85 years

	Co-operating Diabetics	Cardiovascular-renal Diabetics	Uncooperating Diabetics	Uncooperating Diabetics*
Number	88	39	40	38
Mean Value	40.2	41.4	65.6	46.7
Standard Deviation	27.3	21.1	88.4	27.9
Probability	1	.7	.08	.16

*Uncooperating Diabetics group omitting 2 cases in which values were over 350.

For S_f 12-20 lipoproteins it may be seen that the mean and the standard deviation of the cooperating diabetics does not differ from the normals or from the cardiovascular-renal diabetics. The mean for the uncooperating diabetics does appear to be higher, 65.6 mg. per cent. However, the four-fold increase in the standard deviation from 22.1 to 88.4 indicates that the uncooperating diabetics consist of a much more heterogeneous population than the other groups. Examination of the individuals in uncooperating diabetic group reveals the presence of two cases in which the S_f 12-20 values were extremely high—above 350 mg. per cent. When these are eliminated, it may be seen that the standard deviation and the mean for S_f 12-20 lipoproteins approaches that of the other groups. When we test the probabilities of differences existing between the diabetic groups and the normal group, it appears that there is practically no chance of a difference in S_f 12-20 lipoproteins between cooperating diabetics and the normal group, 7 chances out of 10 that there is no difference between cardiovascular-renal diabetics and normals, and 16 chances out of 100 that there is no difference between the uncooperating diabetics group (where two cases having values over 350 were omitted) and normals.

Therefore, our data, at this time, do not demonstrate a clear difference among any of these groups of diabetic males and normal males when both high and low values of S_f 12-20 are given equal weight in the analysis of the data.

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