

# THE CORRELATION BETWEEN LOW DENSITY LIPOPROTEIN AND SERUM TOTAL CHOLESTEROL

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It is known that there is a close association between various diseases and serum lipids and that low density lipoproteins carry the major portion of serum cholesterol and tri-glycerides. A new and practical method for the estimation of low density lipoproteins has been developed.<sup>1</sup> Gofman and associates<sup>2</sup> have presented a large amount of data suggesting a significant relationship between low density lipoproteins and the incidence of various pathological conditions, particularly coronary arterial disease. Previous methods for measurement of low density lipoproteins were complex, expensive and difficult to interpret. Development of an antiserum specific for human low density lipoproteins (LDL) has made possible the measurement of these substances by an immunochemical method. Heiskell et al<sup>3</sup> found a close correlation between the beta-lipoprotein immunocrits and the beta-lipoproteins determined either by paper electrophoresis or by the poly-anion precipitation technique.

Low density beta-lipoproteins carry the major portion of the cholesterol and tri-glyceride fractions. By determining the low density lipoprotein (LDL) the level of serum cholesterol can be estimated. The commonly used methods are expensive and time-consuming compared to the rather simple and inexpensive immunocrit method.

In the study presented here, serum beta-lipoprotein and cholesterol were both determined from samples obtained from normal controls as well as from patients with a variety of disorders. The data are evaluated from the point of correlation between the serum levels of these two substances, beta-lipoprotein and cholesterol.

## *Methods and Materials*

Antihuman beta-lipoprotein precipitin serum, which is specific for human low density lipoprotein, has made possible the measurement of these substances by an immunochemical method and is available from Hyland Laboratories. The antiserum is obtained from animals by hyperimmunization with human serum beta-lipoprotein

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isolated by ultracentrifugation. This antiserum gives a specific reaction with beta-lipoprotein and produces rapid and complete precipitation of the low density lipoproteins (density less than 1.063 gm/ml).

The test should be performed on serum rather than on plasma. The serum may be frozen, refrigerated, fresh or inactivated. In our studies we used fresh, unfrozen serum. The procedure was performed by :

1. drawing test serum into a dropper and placing two drops on paper beta-L test slide;
2. adding one drop of human serum, using large capillary tube with bulb attached;
3. mixing thoroughly antiserum and human serum with toothpick or applicator held almost horizontally;
4. spreading mixture over indicated area on beta-L test slide, using 10 to 12 circular strokes;
5. filling immunocrit tube up to the mark by capillary attraction;
6. flame-sealing empty end of tube;
7. placing sealed end of capillary tube toward outside rim of centrifuge and spinning for five minutes;
8. reading length of column, estimating to nearest 0.1 millimeter. (For accurate, consistent readings, viewer, tube holder and millimeter scale were used.)

Normal immunocrit value ranges approximately between 1.5 mm and 2.7 mm. Those under 20 years of age usually show values near the low end of this range.

### *Results and Discussion*

In our study the serum beta-lipoproteins were measured by the immunocrit method in sera collected from 78 subjects, 73 with a wide variety of general medical diseases and five healthy. In each case the serum total cholesterol contents were determined concomitantly with the colorimetric method.

In 36 of a total of 78 subjects, total cholesterol and beta-lipoprotein (BLP) levels were both normal; in 31 both were elevated; in seven both were decreased. In one subject, cholesterol was normal, but BLP was elevated. In another, cholesterol was slightly elevated, but BLP was normal; in a third, cholesterol was normal, but BLP was slightly decreased; and in a fourth, cholesterol was decreased, but BLP was normal (Table 1).

TABLE 1

| Classification of subjects | number of cases | *<br>**<br>Chol. and BLP both were normal | Chol. and BLP both were elevated | Chol. and BLP both were decreased | Chol. was normal BLP was elevated | Chol. was elevated BLP was normal | Chol. was normal BLP was decreased | Chol. was low BLP was normal |
|----------------------------|-----------------|-------------------------------------------|----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|------------------------------------|------------------------------|
| Healthy                    | 5               | 5                                         |                                  |                                   |                                   |                                   |                                    |                              |
| General medical diseases   | 73              | 31                                        | 31                               | 7                                 | 1                                 | 1                                 | 1                                  | 1                            |
| Total                      | 78              | 36                                        | 31                               | 7                                 | 1                                 | 1                                 | 1                                  | 1                            |

\*Chol = Cholesterol

\*\*BLP = Beta-Lipoprotein

It is obvious from these data that BLP and cholesterol levels are in direct proportion in 74 out of 78 subjects; in four subjects there is no significant parallel. This discrepancy might be explained by technical errors; for example, the shape of the flame-sealed immunocrit tube or the size of the drop.

The results given in Table 1 were studied statistically. It is interesting that there was a correlation between beta-lipoproteins and serum cholesterol. The correlation coefficient was  $85.6 \pm 6.18$  per cent. Further study of the relationship between these two variables gave the following equations :

$$\begin{aligned}x &= 68.434 y + 57.8 \\y &= 0.0107 x + 0.1\end{aligned}$$

in which x represents cholesterol in milligram per cent and y, beta-lipoproteins in millimeters. Thus the average cholesterol values can be found when either BLP or cholesterol is known.

### *Summary*

The low density lipoprotein test is a simple procedure which in most instances shows any deviation from the normal relation between beta-lipoproteins and cholesterol. This parallel is disturbed in only five per cent of the subjects. Therefore it can be used as a simple, inexpensive and rapid screening test for cholesterol determinations.

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### *REFERENCES*

1. Beta-L test and Immunocrit, Hyland Laboratories, Los Angeles, California.
2. Gofman, J. W. et al : Index of coronary artery atherogenesis, *Modern Med.* 15 : 119, 1953.
3. Heiskell, C. L., Fisk, R. T., Florshelm, W. H., Tachia, Goodman, J. R. and Carpenter, C. M. : A simple method for the quantitation of serum beta-lipoproteins by means of the immunocrit, *Amer. J. Clin. Path.* 35 : 222, 1961.
4. Chaney, A. L., Fisk, R. T., Lou, K. and Cochran, B. Jr. : An immunochemical approach to beta-lipoprotein analysis, *Clinical Research* 9 : 99, 1961.
5. Keys, A., Anderson, J. T. and Grande, F. : Essential fatty acids, lipid metabolism and atherosclerosis, *Lancet* 1 : 742, 1958.
6. Bergquist, L. M., Carroll, V. P. Jr. and Searcy, R. L. : Evaluation of a specific antiserum-beta-lipoprotein estimations, *Lancet* 1 : 537, 1961.