Further Experiences with Blood Coagulation after Fat Meals and Carbohydrate Meals

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There have been conflicting reports as to whether the ingestion of fat increases the tendency for the blood to clot, and hence, by implication, the risk of thromboembolic complications in man. In this study the effect of a single meal containing a large amount of fat was compared with that of a practically purely carbohydrate isocaloric meal. Under carefully controlled conditions the clotting time varied widely under fasting conditions, and after both fat and carbohydrate meals the clotting time became longer, shorter, or remain unchanged. The results were unpredictable and although a slight trend toward shortened clotting times was evidenced after the fat meals, the results did not reach accepted statistical standards of probability.

In 1949 Duncan and Waldron\(^1\) reported an acceleration of blood clotting time after the oral administration of fat. An original report from this department\(^2\) casts doubt on this finding and it was suggested that the acceleration of clotting may well have been due to deposition of thrombin on the surface of glass syringes when they were reused for successive venipunctures. Then Waldron and Duncan published data that they believed substantiated their original claims.\(^3\)

Buzina and Keys,\(^4\) working with physically healthy men, aged 35 to 60, and using a larger amount of fat, reported a significant shortening of the whole blood coagulation time but no alterations after the ingestion of isocaloric, nonfatty meals. English workers\(^5-12\) have reported on different aspects of this problem.

Hall\(^5\) related clotting variations after a fat meal to platelet preservation and stated that there was no change in blood coagulation when adequate platelet activity was present. Barkhan, Newlands, and Wild\(^6\) have isolated from human brain tissue a phosphatidylethanolamine that they found to be an accelerator of coagulation. O'Brien\(^9\) believes that behavior of phosphatidylethanolamine and platelets is similar. Studying further the effects of eggs and different fats on blood coagulation,\(^11\) he found a shortening of Stypven clotting times 1\(\frac{1}{2}\) to 2\(\frac{1}{2}\) hours after a meal. There were considerable differences among individuals but no significant differences among different types of fat meals. There is some question whether the Stypven clotting time may actually be measuring the fat in the blood rather than an actual change in the clotting mechanism.

MacLagan and Billimoria\(^12\) reported definite shortening of the clotting time after feeding 2 ounces of fat food, the maximal effects taking place 4 to 6 hours after a test meal.

Because of the opposing conclusions reached by different investigators and because Buzina and Keys\(^4\) believed they found statistically significant support of acceleration of clotting times with a fat meal after re-analysis of the data of Tulloch, Overman, and Wright,\(^2\) it was decided to try to reproduce as closely as possible the work of Buzina and Keys and to evaluate the results.

Methods

Blood was withdrawn from an arm vein with siliconized syringes and 20-gage needles. If there was any difficulty in obtaining blood, a new venipuncture was done in the opposite arm with a new needle and a new syringe. A stopwatch was started as soon as blood entered the syringe. The tourniquet was kept in place no more than 60 seconds. One milliliter of blood was added to
Fig. 1. Variation of clotting times under fasting conditions.

measured under fasting conditions. The variation for clotting times in the same individual during the same day ranged from 7 minutes to 31 minutes between the first and the third sample. Variations in the same individual for different days ranged from 20 minutes to 33 minutes. In contrast with the report of Buzina and Keys, our clotting times during continued fasting were either longer or shorter than the initial one.

Table 1 shows the summary of our experiments and the statistical analysis. Because of the variations found in fasting clotting times, the following steps were used to calculate the mean values.

The variation of clotting times of samples from each individual were calculated first after fat meals and then after carbohydrate meals, by subtracting the values found at the 1, 2, 3.5, 4.5, and 5.5 hours from the corresponding fasting value. Plus (+) signs indicate shortening and minus (−) signs lengthening. When the + or − variations were calculated for the whole group, the mean was found for the values at the 1, 2, 3.5, 4.5, and 5.5 hour levels after the test meals and the difference between the fat and carbohydrate values was calculated.

Because no appreciable difference was found in the age groups of 19 to 30 and 35 to 70, the experiments were analyzed to include a total of 29 patients. Statistically significant acceleration of the clotting times after a high-fat meal was not found. The maximal effect was at the end of the second
Our next step was to analyze the data by means of a paired contingency table. For the contingency table the responses were classified as positive, negative, or unchanged. The designation “unchanged” did not mean that the readings were identical but rather that they fell within the limits of variation inherent in the technic. The inherent variation, determined from the differences between duplicates, was found to be approximately plus or minus 4 minutes.

Table 2 shows the results with the average responses at 3.5, 4.5, and 5.5 hours after meals. After a fat meal the blood of 14 individuals showed a positive response, i.e., a decrease in clotting times, and 5 an increase or negative response. After the isocaloric carbohydrate meal, a total of 12 individuals had a positive response (shortening) and 6 a negative one (lengthening). A sign test was applied to the results, for both fat and carbohydrate, those individuals being disregarded whose clotting times were unchanged by their test meals when compared to their fasting times.

Here again there was no statistically significant difference between the changes induced by fat and those produced by carbohydrate. As in our original statistical presentation (table 1), the sample that showed the nearest approach to statistical significance was at the second hour. The results with a paired contingency table were also analyzed (table 3). A total of 16 patients showed a decrease in clotting times following a fat meal. Four showed an increase.

Following carbohydrate meals, 10 showed a decrease compared with their fasting clotting times and 11 an increase. In this experiment the sign test showed a statistical significance between the 5 per cent and the 1 per cent level after the fat meal. The apparent discrepancy between the statistical data in table 1 and table 3 is a function of the characteristics of the different tests employed. Table 1 presents the results of analysis by means of the t test, a measure of degree of change. In table 3 the data presented are the result of application of the nonparametric sign test, a measure of direction of change only. Thus table 1 represents a slightly more efficient evaluation and while the values at the end of 2 hours approach significance, the criteria of significance are not achieved. When the first series of individuals, 19 to 50 years old, were tested, heparin tolerance tests, Stypven clotting times, prothrombin times, and thrombin generation tests were done in the first 10 individuals but abandoned thereafter because no changes were found.

Discussion

Because of the important and controversial issue involved, special care was taken in the conduction of the present study. Subjects were selected for their willingness to cooperate and the presence of good veins suitable for adequate venipuncture.

The small group of 10 subjects aged 35 to 70 were ambulatory hospital cases, without evidence of metabolic disturbances, liver disease, gastrointestinal pathology, or renal
BLOOD COAGULATION AFTER FAT AND CARBOHYDRATE MEALS

The ingestion of a meal containing a large amount of fat encourages intravascular clotting, it is recognized that all existing methods of investigation of this mechanism are relatively crude and that such a possibility exists through a system not yet discovered.

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SUMMARY

The results of studies of changes in the coagulation time after a fat and a carbohydrate test meal ingested by 29 subjects are presented. It was found that the whole blood clotting times in siliconized tubes following the Lee-White method as modified by Buzina and Keys varied from individual to individual and in the same subject during the course of one day and from one day to another. Although there seems to be a slight trend toward shortening of clotting times following a standard fat meal, the results do not reach accepted statistical standards of probability. These experiments fail to confirm or deny the claim that fat ingestion accelerates to a significant or consistent degree the whole blood clotting time. A similar inconclusive trend toward shortening of the clotting time was observed following the ingestion of a carbohydrate meal in a substantial proportion of the tested individuals. Additional studies including the Stypven clotting time, heparin tolerance, prothrombin time, and thrombin generation, failed to show any trend toward increased speed of clotting. While these studies fail to demonstrate that...
ente methodos pro le investigation de iste
dechianismo es relativemente crude. Il
remane possibile que le phenomeno in qu-es-
tion va esser demonstrate per medio de un
systema non ancora discoperite.

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to the usual therapy. Fluoroscopically forceful esophageal pulsations may be observed
at the level of the left atrium. If the atrial tumor is large enough, cardiac catheteriza-
tion reveals pressure elevation in the right ventricle and in the pulmonary artery. In
the pulmonary wedge-pressure curve an early positive deflection replaces the normal dip
during ventricular systole. Finally angiocardiography reveals a filling defect within
the shadow of the atrium.
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