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MEAL UPON THE BLOOD SUGAR
LEVEL IN HEALTH AND IN
CERTAIN CONDITIONS OF
DISEASE

A Simple Food Tolerance Test

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THE EFFECT OF A NORMAL MEAL UPON THE BLOOD SUGAR LEVEL
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A SIMPLE FOOD TOLERANCE TEST

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THIS study was undertaken with a view to developing a simple method for the determination of abnormal glycemic reactions. It is intended as a substitute for the glucose tolerance test now in general use in clinical and metabolic laboratories. This latter test is the result of the work of many authors, notably Bang, Hopkins, Hamman and Hirschman, and Janney and Isaakson. The value

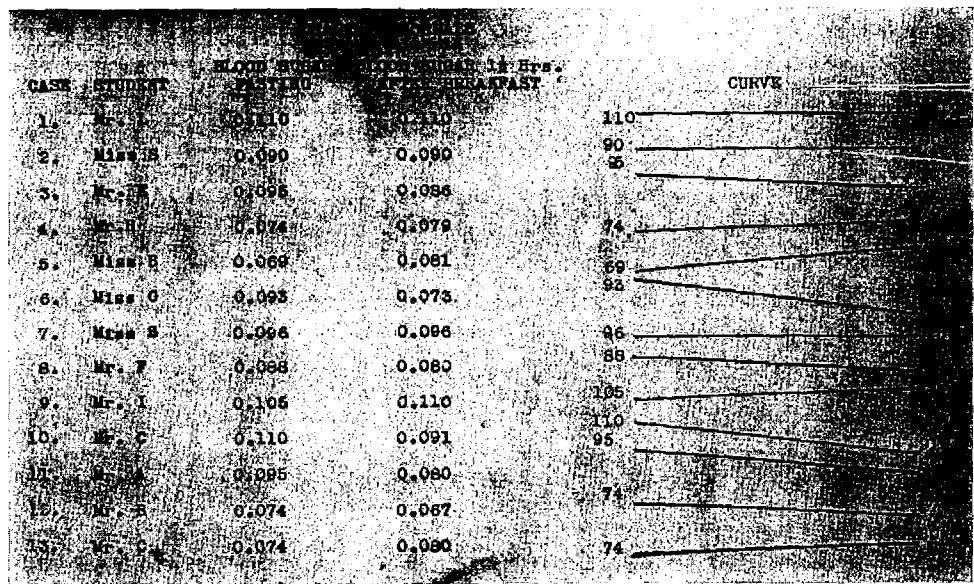


Chart I.—The results of the glycemic reactions in thirteen normal individuals—all healthy students of the University of Oregon Medical School. It will be noted that the lines obtained are almost horizontal. The highest rise is 12 mg., while some present even a slight fall.

of the procedure as an aid in the study of various metabolic disorders is too well recognized to require further comment at this time. Some three years ago, while studying a number of cases of suspected and of some early known diabetes, it occurred to me that the use of a comparatively large quantity of glucose (which is necessary in the performance of the glucose tolerance test) is not entirely free from objections. First, the mixture is nauseous and distasteful to the patient; second, there may be some element of danger (theo-

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CHART II MILD DIABETICS

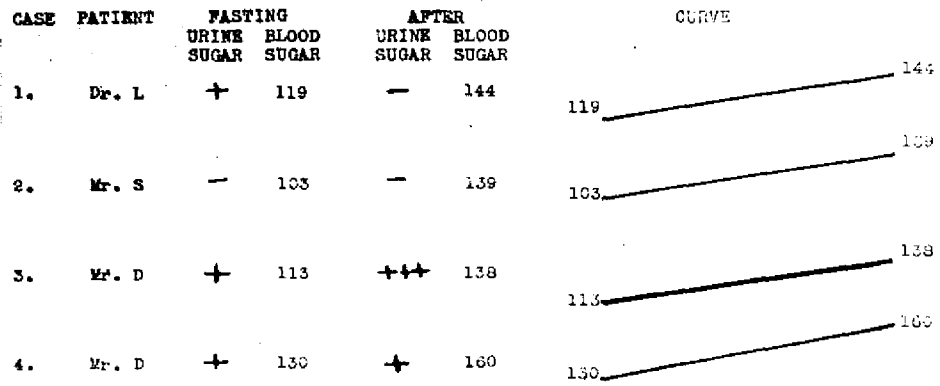


Chart II.—The result in known mild diabetes. Note all show a definite rise of from 5 to 36 mg. The fasting level is also apt to be higher than in the normal, although in mild cases it may not be so. In this group the fasting level was within normal limits in three of the four cases.

CHART III DIABETES BEFORE TREATMENT

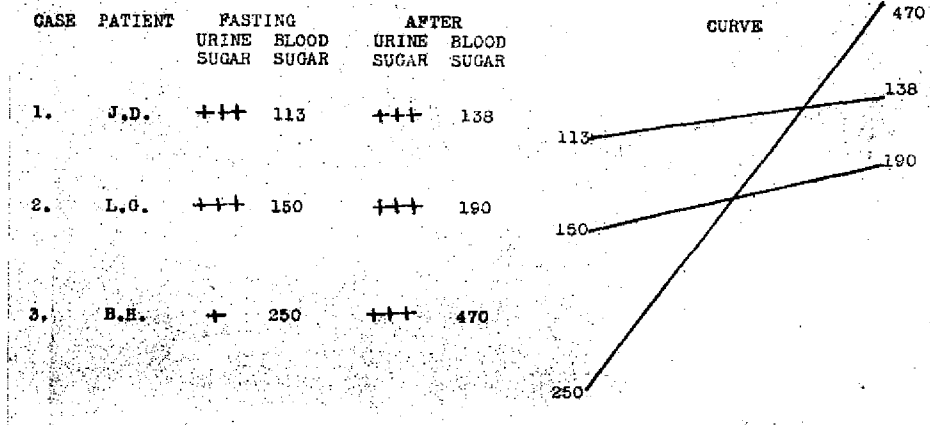


Chart III.—Results in three cases of diabetes, mild, moderately severe and severe, respectively.

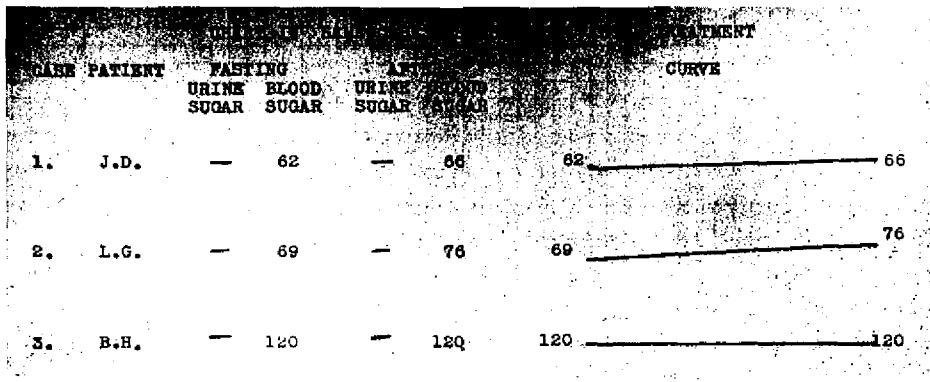


Chart IV.—Results in same three cases as shown in Chart III after treatment.

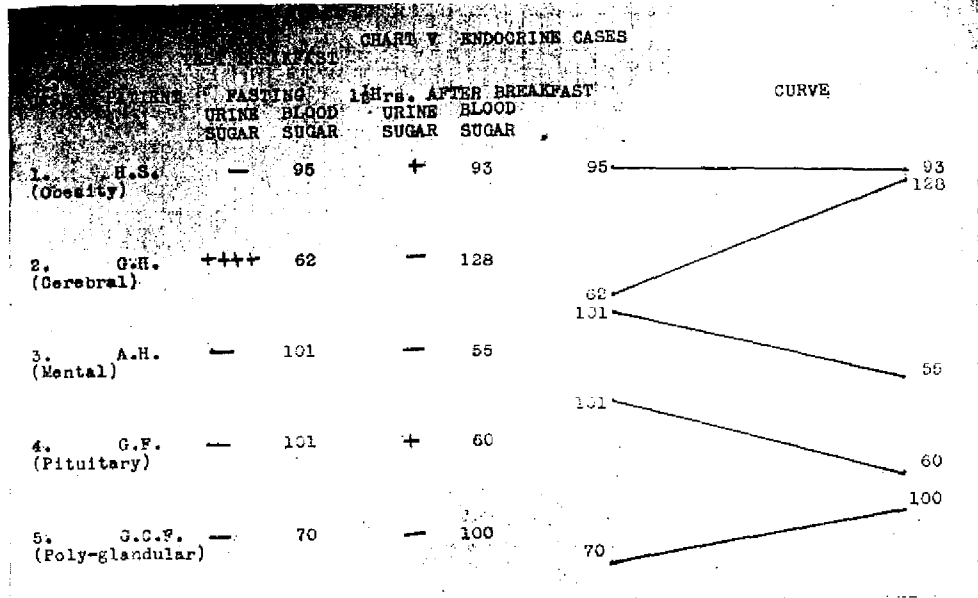


Chart V.—Results of the study of five endocrine cases. One of these cases showed nothing abnormal except for obesity. It will be noted that her glycemic reaction was practically normal. The other four cases all showed definite endocrine disorders and they all gave characteristic irregular glycemic reactions.

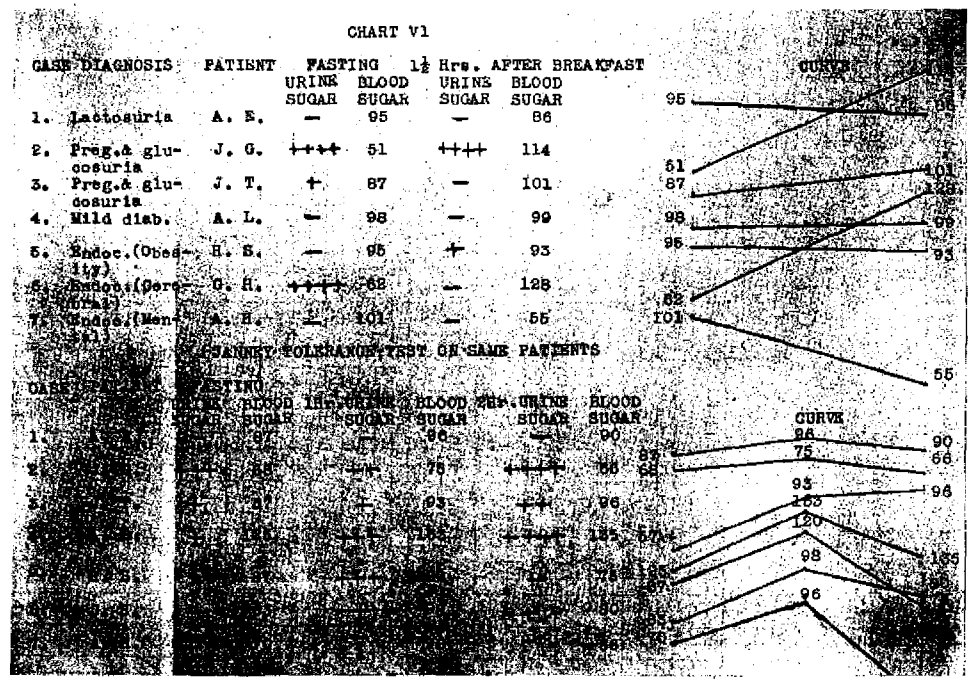


Chart VI.—The results of seven cases in which this test was used as an aid in establishing the diagnosis. In all these cases the findings were further checked up with the glucose tolerance test and as may be seen from the chart, the results were quite parallel. Two of these cases deserve special notice. They were cases of pregnancy with well marked glucosuria. (Cases 2 and 3). The question of terminating the pregnancy came up in each instance. Upon the basis of the findings by our test, I recommended to allow the pregnancy to continue. Only moderate restriction in carbohydrates was advised. Both cases were carried to a successful delivery without the slightest mishap. Both the mother and the child in each instance are living and well today.

retically, at least) in overloading a weakened tolerance by rapid and sudden absorption of a comparatively large quantity of pure glucose. These considerations led me to make a comparative study of the effects of an average normal breakfast upon the blood sugar content in normal individuals and in various chronic conditions in which the food tolerance is known to be affected. The results obtained are presented in the accompanying charts. The studies here recorded were all done in the latter part of 1919 and early part of 1920. Since these records were compiled, numerous other cases were similarly studied with identical results. However, in order to avoid repetition of figures and for the sake of clearness, only the original charts are here presented.

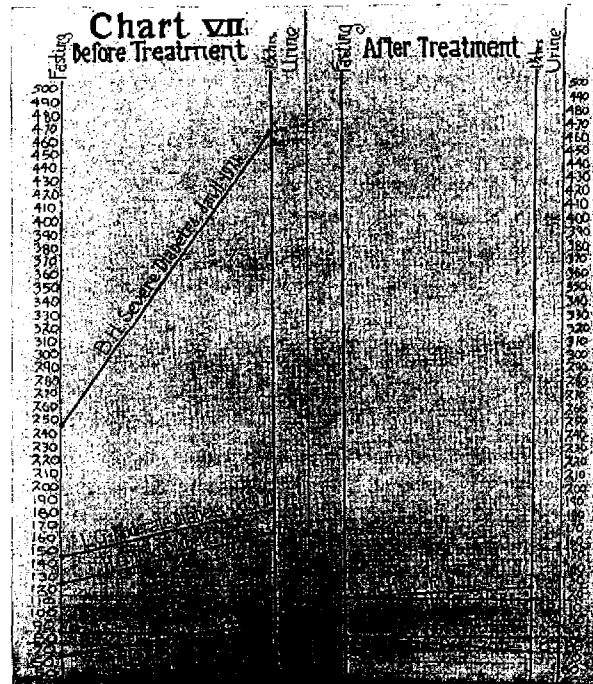


Chart VII.—Summary of the previous charts. On the left side of the mid-line curves are shown of the cases before they were treated. The dates of the estimations and the diagnoses are indicated. On the right side of the mid-line, the same cases with the dates of the subsequent estimations are shown. The same scale is used in order to show the marked contrast in the curve in different conditions, and in the same conditions before and after treatment.

In making this comparative study, the following factors were considered:

First, *the time*. It was shown by Mosenthal and others that in diabetes the maximal percentage of blood sugar occurs between one and two hours after breakfast and that after luncheon and evening meals the rise is not so constant and the sugar may, in fact, even fall. On the other hand, in normal individuals, I have found the blood sugar to be most nearly constant after the morning meal, while, after luncheon, it is apt to rise higher than normal. Breakfast time, therefore, will afford the greatest contrast between the normal and the abnormal conditions.

Second, *the meal*. In order that the test may be a true food tolerance test all the food elements should be represented in the test meal, and it therefore included the usual breakfast foods, namely: bread, butter, cereals, eggs, sugar, coffee and cream, amounting to approximately 100 grams of carbohydrates, 26 grams of protein, 27 grams of fats and 760 calories.

Third, *the curve*. Two estimations only were done, fasting and an hour and a half after breakfast. These two estimations form a line which may be horizontal, rising or falling. Normally an hour and a half after breakfast the blood sugar is within ten milligrams of the fasting level and the two estimations furnish almost a horizontal line. In diabetes, however, a greater difference is found, the second level being considerably higher than the first and, therefore, a rising line is obtained. The difference may best be learned by an examination of Charts 1 and 2.

CONCLUSION

1. A comparatively simple method is suggested to serve as a true tolerance test.
2. In all the cases tried so far, it corresponds very closely in its results with the Janney glucose tolerance test.
3. It is preferable to the glucose tolerance test because (a) it is more simple, (b) it is more agreeable to the patient, (c) and it avoids the danger of overtaxing a weakened function by a large quantity of pure glucose.

I wish to express my thanks to Prof. Howard D. Haskins from the department of Biochemistry of the University of Oregon Medical School for assisting me in many of the blood sugar estimations, the results of which form the basis of this study.