

BRIEF NOTES AND COMMENTS

Estimation of the Long-term Control of Diabetes

The Relation of Blood Sugar Levels to Glycosuria

F. I. Caird, D.M., M.R.C.P., Oxford

SUMMARY

A simple and objective method of estimating the long-term control of diabetes and derived from urine tests at routine clinic attendances has been investigated. The per cent of such urine tests showing 2 per cent glycosuria (glycosuria percentage) is shown to be significantly related to the mean of blood sugars determined at the same attendances. This relationship is unaffected by the number of clinic attendances, if these number five or more. *DIABETES* 16:502-03, July, 1967.

It is not yet fully established what effect good control of diabetes has on the risk of development of long-term complications. One major problem in determining this relation is estimation of control of diabetes.

The present study is an assessment of a simple and objective method for the estimation of the long-term control of diabetes which could be applied retrospectively to the case records of groups of diabetics attending clinics.

METHODS

A study was made of the case records of 201 diabetics from a group chosen at random¹ from patients attending the Diabetic Clinic at the General Hospital, Birmingham. Since the beginning of 1948 blood sugar has been routinely measured on all patients at every attendance at the clinic. Blood was taken in almost every instance between 1 and 3 p.m., but the time and size of the midday meal was not constant. The blood sugar was measured in earlier years by the Folin-Wu method, and more recently by the glucose oxidase method as modified for the AutoAnalyzer. The urine specimens were obtained at the time of clinic attendance, or were collected by the patient at home. Their timing in relation to the blood specimen thus varied considerably. Urine sugars were estimated by Benedict's method or by Clinitest.

Only patients with five or more clinic attendances for which both blood and urine sugars were recorded were considered. The blood sugar was read from the records to the nearest 10 mg. per 100 ml. The mean of the blood sugars for the first five attendances could be calculated for all 201 patients, for the first ten attendances for 159 patients, and for the first twenty for eighty patients. The proportion of urines recorded as showing glycosuria of 2 per cent or more was similarly calculated. This is termed the "glycosuria percentage."

From the Radcliffe Infirmary, Oxford, England.

RESULTS

The distribution by age and sex of the 201 patients at time of the clinic attendance leading to entry into the study is shown in table 1.

TABLE 1
Age at entry into study

	0-19	20-39	40-59	60-79	80+	Total
Men	5	14	42	21	1	83
Women	3	9	59	46	1	118
Total	8	23	101	87	2	201

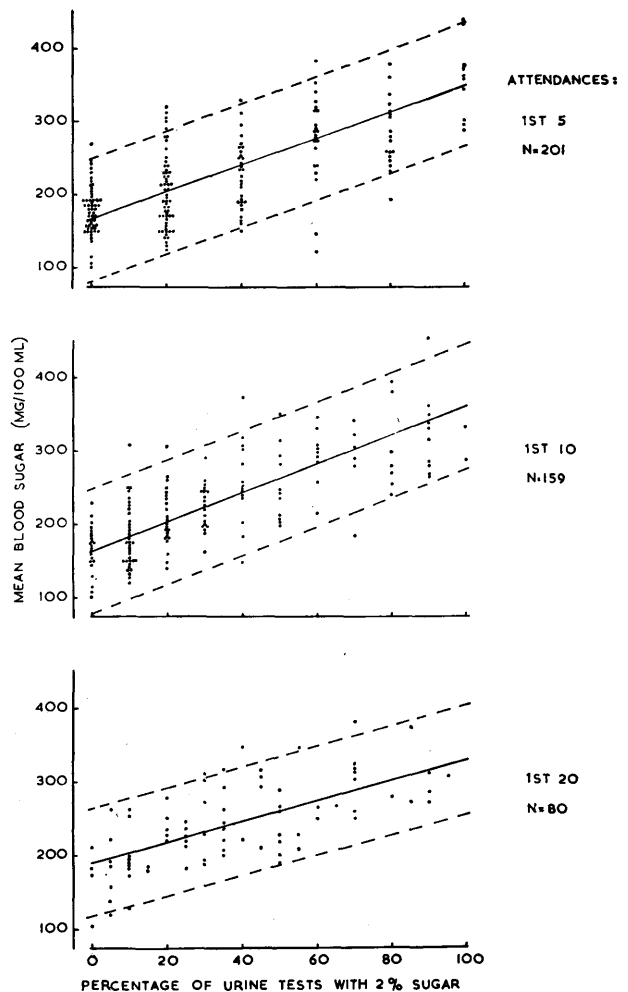


FIGURE 1

TABLE 2

Statistics of correlations between mean blood sugar and per cent of urine tests showing 2 per cent glycosuria

Number of attendances	Number of patients	Average per cent of 2 per cent glycosuria	Average mean blood sugar	Regression coefficient \pm S.E.	Sample standard deviation	Correlation coefficient
5	201	32.3	225	1.84 \pm 0.10	42.4	0.79
10	159	31.8	226	1.97 \pm 0.13	42.7	0.77
20	80	36.6	242	1.37 \pm 0.16	37.1	0.69

The relationship between the mean blood sugar and the per cent of urine sugars of 2 per cent or more is shown in figure 1 for five, ten, and twenty attendances. In each instance the relationship is linear, similar and significant at the 1 per cent level (table 2). The regression lines are the same for patients over the age of sixty at entry into the study as for those under that age.

DISCUSSION

Hyperglycemia is one component of the metabolic disturbance of diabetes which is diagnostic and easily measurable. It is thus rational to use some derivative of the blood sugar as an index of deviation from metabolic normality. The mean of blood sugars determined at routine clinic attendance is one such derivative, but if the blood sugar is not measured on every clinic attendance, a true mean value cannot be calculated. Some figure derived from urine sugar may thus be desirable. The findings in this study show a good correlation between a figure derived from urine sugar and the mean blood sugar. This correlation is not improved by increase in the number of clinic attendances above five, nor is it affected by

any age-dependent variation in renal threshold. The percentage of urine tests at routine clinic attendances which show glycosuria of 2 per cent or more (glycosuria percentage) is thus a possible measure of the long-term control of diabetes, which can be applied to groups of patients, but is obviously limited in its application to individual patients. It is clearly by no means the only such measure; if available, a figure derived from blood sugar is much preferable. Nevertheless, the simplicity and objectivity of the method are much in its favor, as is the ease with which it can be applied to case records going back many years.

ACKNOWLEDGMENT

My thanks are due to Dr. J. M. Malins for permission to study the records of patients under his care, to Drs. N. Mayne and M. G. Fitzgerald for their assistance, and to Dr. T. D. R. Hockaday for advice and criticism.

REFERENCES

¹ Mayne, N.: Neuropathy in the diabetic and non-diabetic populations. *Lancet* 2:1313-16, 1965.