Comparison of Dextrostix/Reflectance Meter and Auto-Analyser Methods of Blood Glucose Determination*

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SUMMARY

A study was undertaken to assess the accuracy of a new Dextrostix/Reflectance Meter system for rapid blood glucose determinations over a wide range of values, in 390 consecutive patients attending a busy diabetic clinic. In each case a simultaneous comparison with the ferricyanide reduction method on the auto-analyser was made. While a good correlation existed between the two methods for blood glucose values below 200 mg/100 ml, above this level significant discrepancies became apparent. Reasons for this are briefly considered and practical applications of the findings are discussed.

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There are obvious advantages of having a rapid, accurate method for blood glucose determination. With the introduction of a sensitive colour meter (Reflectance Meter; Ames) to improve the accuracy of the enzyme test strip (Dextrostix; Ames) estimations of blood glucose, a potentially suitable technique became available. Indeed, preliminary studies[1-3] have claimed a very high correlation between this procedure and the standard auto-analyser method. Since these reports were either confined to normal subjects or to relatively small numbers of diabetics, the need for a more extensive study, covering a wide range of blood sugar values, became apparent.

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MATERIAL AND METHODS

Patients attending the Diabetic Clinic at the Johannesburg Hospital were the subjects of the investigation. Over a 12-week period, 390 consecutive diabetics were tested. In each instance a venous whole blood sample was obtained on arrival at the Clinic. Part of this was used to fill a fluoride

tube for auto-analyser (Technicon) blood glucose determination, employing the modified ferricyanide method of Hoffman.[4] The remainder was used to completely cover the test area of a Dextrostix strip and then washed off with a jet of water exactly 60 seconds later. After blotting lightly, the strip was placed in the Reflectance Meter and the blood glucose value read off the appropriate scale. A single, trained observer performed all the readings. The instrument was calibrated before use by means of a standard colour chip (set at 130 mg/100 ml).

The paired glucose results for each patient were subsequently recorded and, at the completion of the study, submitted for statistical evaluation. (The coefficient of variation on the auto-analyser was ± 4% for the method.)

RESULTS

A scatter diagram of blood glucose results obtained in the 390 comparisons is presented in Fig. 1. If glucose values are arbitrarily divided, at 200 mg/100 ml (auto-analyser method), into high and low ranges, then in the low range

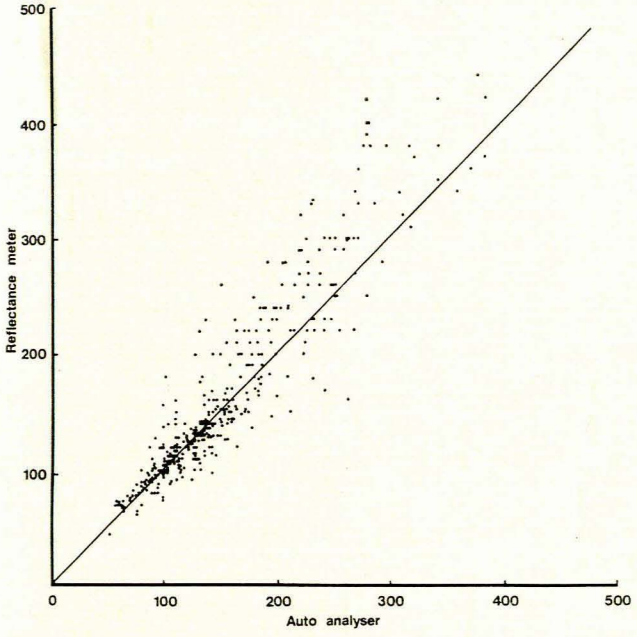

Fig. 1. The blood glucose values (mg/100 ml) obtained by the two methods in 390 comparisons. The line drawn represents perfect agreement.

a close correlation exists between the two methods ($r = +0{\cdot}75$). From inspection of the graph, however, it appears that the Reflectance Meter generally overreads by comparison with the auto-analyser in the high range above 200 mg/100 ml. This is confirmed in Table I, where mean Reflectance Meter blood glucose levels are shown to be significantly ($p<0{\cdot}01$) higher than corresponding auto-analyser results. In 32 out of 83 paired determinations in this range, there was more than a 50 mg/100 ml difference between the two sets of glucose values.

TABLE I. COMPARISON OF THE TWO METHODS AT HIGH RANGE OF BLOOD GLUCOSE VALUES

Method	Mean blood sugar (mg/100 ml)	Standard deviation	Standard error of mean
Dextrostix/ Reflectance Meter	**289**	**71**	**8**
Auto-analyser	**259**	**48**	**5**

DISCUSSION

The principal question to be answered is whether the Dextrostix/Reflectance Meter system can give reliable blood glucose estimations over a wide range of values in a large number of subjects. From our study, it is clearly capable of doing so for (auto-analyser) blood sugars below about 200 mg/100 ml. Above this level discrepancies become apparent, and in individual cases these may be large enough to cause errors in patient management.

In considering reasons for the tendency of the Reflectance Meter to overread at high levels, there are a number of possible explanations. The lack of a standardization chip for the high colour-range of the meter (180 - 1 000 mg/100 ml) made it impossible to identify electronic faults during range change. In performing the test, any extension of the reaction time of Dextrostix beyond 60 seconds will have a much greater effect at hyperglycaemic levels; even though one may time accurately to 60 seconds, the reaction will continue for a variable period until washing is complete.[5] On the other hand, when using the auto-analyser, it is customary to *dilute* blood glucose values above 200 mg/100 ml in order to utilize the most accurate part of the standard curve; diluting procedures, however, are impractical with the Reflectance Meter technique.

Regarding practical implications of our results, the Reflectance Meter—by improving the accuracy of the Dextrostix strips—seems suitable for rapid blood sugar screening in situations such as the diabetic clinic, areas remote from laboratory facilities; clinical emergencies and possibly diabetic population surveys. However, when values above 200 mg/100 ml are recorded, a check with a more precise laboratory method seems desirable at the present time.

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