
Michael Mayer*
Lea Salpeter
Dept. of Clin. Biochem.
Hadassah Hosp.
Hebrew Univ.-Hadassah Med. School
P. O. Box 12000
Jerusalem, IL-91120 Israel

*Author for correspondence. Fax 972-2-6435778; e-mail mayer@hadassah.org.il.

Toxic Levels of Acetaminophen Produce a Major Positive Interference on Glucometer Elite and Accu-check Advantage Glucose Meters

To the Editor:
Bedside capillary glucose monitoring has become widespread in most hospitals. Glucose meters have been shown to provide a reasonably acceptable degree of accuracy compared with laboratory instruments when proper quality control is in place (1). However, a recent clinical case shows that such systems have limitations in hospital settings.

A 55 years-old woman was admitted to the emergency room with suspected acetaminophen overdose. She had been found lying on the floor of her apartment in an altered level of consciousness, and a bottle of acetaminophen was discovered beside her. The patient had recently been hospitalized for a period of three months for depression. She had no history of diabetes. Capillary blood glucose as measured with the Glucometer Elite (Bayer) at the emergency room showed values of 8.4, 12.8, and 9.4 mmol/L (samples taken within 2.5 h of arrival). Serum analysis in the laboratory (Vitros 700 XR) gave glucose values <1.1 mmol/L for two different samples taken during that same time interval. Because of the discrepancy between the capillary glucose meter values and the serum glucose values measured by Vitros, the patient's serum was analyzed for glucose at another laboratory by Synchron CX-3 (0.11 mmol/L), Synchron CX-5 (0.2 mmol/L), and Radiometer EML 105 (0.0 mmol/L). Her serum acetaminophen (Vitros 700 XR) was at the highly toxic concentration of 2904 μmol/L. Despite appropriate treatment, the patient died the next night.

After ruling out a glucose meter defect as the source of the erroneously high glucose readings, acetaminophen interference was suspected. We therefore measured glucose on heparinized venous blood supplemented with different amounts of acetaminophen (50 μL of aqueous solution per mL of blood). The blood samples were drawn from healthy volunteers who were not taking any medication. Some of these blood samples were made hypoglycemic by incubation at 37 °C for 4 h. Confirmation of acetaminophen concentrations was done by measurement on a Vitros 700 XR. Simultaneous measurements of venous blood glucose was done on five different glucose meters according to the manufacturers’ instructions. Glucose measurements were also done on whole venous blood (EML 105) and plasma (Vitros 700 XR, Synchron CX-3, and CX-5). Results of the glucose measurements on the Glucometer Elite (meter #1) and the Accu-check Advantage (meter #2) showed a positive interference that increased with the amount of acetaminophen added (Table 1). Maximal deviations of 4.4 and 4.5 mmol/L were seen at the highest acetaminophen concentration. The Precision QID (meter #3) showed a negative interference (1.0 mmol/L at the highest acetaminophen concentration). No interferences were seen from the One Touch Profile (meter #4), the SureStep (meter #5), and from the laboratory glucose measuring instruments, including the EML 105. The Glucometer Elite and the Accu-check Advantage were used to measure a low blood glucose value in the presence of the highest acetaminophen concentration tested above. A positive interference of the same amplitude was again observed (4.4 and 4.1 mmol/L, respectively), showing that the extent of the interference varied directly and in an absolute fashion with acetaminophen concentration, regardless of actual glucose concentration.
It is worth noting that the three glucose meters that showed an interference measure glucose by electrochemical methods. The reflectance methodology used in the other two glucose meters did not show such an interference. The kit inserts provided by the manufacturers of Elite and Accu-chek Advantage do not state that such interference exists. The Precision QID information package does discuss a possible negative bias. The issue of interferences from reductive compounds such as acetaminophen on electrochemical glucose sensors has been addressed before (2). Despite a 1992 report (3) on the Glucometer Elite glucose meter (another brand name for the Bayer Elite), which identified a positive bias with acetaminophen, this issue has not been addressed in the recently published reports dealing with electrochemical glucose meters (4–10). Kit inserts should carry this information. The magnitude of the positive bias seen here with the Glucometer Elite and Accu-chek Advantage is such that the clinical management of patients suffering from acetaminophen intoxication and its complications (one being hypoglycemia) might be affected negatively.

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References


Louis-Jacques Cartier
Pierre Leclerc
Marcel Poulion
Linda Nadeau
Gilles Turcotte
Bernard Fruteau-de-Laclos*
Service de biochimie
Centre Hospitalier
Affilie´ Univ. de Que´bec
1401, 18e rue Que´bec
Quebec GIJ 1Z4, Canada

*Author for correspondence. Fax (418) 682-8000; e-mail mgbf@mediom.qc.ca.

Why “Urea Nitrogen” When Urea is Measured?

To the Editor:
The paper by Morishita et al. (1) regarding the analysis of urea is confusing. In the text, the authors state that they are measuring urea nitrogen (UN), and it may seem so, because their calibrators were “physiological saline, with and without 17.86 mmol/L UN”. However, the abstract states that analytical recovery of added urea was studied with patient sera containing 6.14 mmol/L urea. In contrast, the text describes patient sera with a UN concentration of 6.14 mmol/L. Because urea contains two nitrogens, these two sentences seem to be incompatible.

I think that if one is measuring urea, one should give the results in SI units (mmol/L) for the whole compound and not for the urea nitrogen. Otherwise, ambiguities arise in the interpretation of the results. Urea should be measured, and “urea nitrogen” should be abandoned as an analyte in clinical chemistry work.

References