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ORIGINAL ARTICLE

Dynamic Electrochemistry Corrects for Hematocrit Interference on Blood Glucose Determinations with Patient Self-Measurement Devices

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Abstract

Background:

It has been demonstrated that dynamic electrochemistry can be used to correct blood glucose measurement results for potentially interfering conditions, such as humidity, hematocrit (HCT) variations, and ascorbic acid. The purpose of this laboratory investigation was to assess the potential influence of hematocrit variations on a variety of blood glucose meters applying different measurement technologies.

Methods:

Venous heparinized whole blood was drawn, immediately aliquoted, and manipulated to contain three different blood glucose concentrations (80, 155, and 310 mg/dl) and five different hematocrit levels (25%, 37%, 45%, 52%, and 60%). After careful oxygenation to normal blood oxygen pressure, each of the resulting 15 different samples was measured 8 times with the following devices: BGStar, Contour, Accu-Chek Aviva, Accu-Chek Aviva Nano, Breeze 2, Precision Xceed, OneTouch Ultra 2, OneTouch Verio, FreeStyle Freedom Lite, Glucocard G+, GlucoMen LX, GlucoMen GM, and StatStrip [point-of-care (POC) device]. Cobas (Roche Diagnostics, glucose hexokinase method) served as laboratory plasma reference method. Stability to hematocrit influence was assumed when less than 10% bias occurred between the highest and lowest hematocrit levels when analyzing mean deviations for all three glucose concentrations.

Results:

Besides the POC StatStrip device, which is known to measure and correct for hematocrit (resulting in <2% bias), four self-test meters also showed a stable performance in this investigation: dynamic electrochemistry, BGStar (8%), and static electrochemistry, Contour (6%), Glucocard G+ (2%), and OneTouch Verio (6%). The other meters failed this test: colorimetry, FreeStyle Freedom Lite (16%), and static electrochemistry, Accu-Chek Aviva (23%), Accu-Chek Aviva Nano (18%), Breeze 2 (36%), OneTouch Ultra 2 (34%), Precision Xceed (34%), GlucoMen LX (24%), and GlucoMen GM (31%).

Conclusions:

As hematocrit variations occur in daily routine (e.g., because of smoking, exercise, hypermenorrhea, pregnancy, stay in mountains, and hemodialysis), our results may encourage use of meters with stable performance under these conditions. Dynamic electrochemistry as used in the BGStar device (sanofi-aventis) appears to be an effective technology to correct for potential hematocrit influence on the meter results.

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Abbreviations: (GDH) glucose dehydrogenase, (MMPD) maximal mean percentage deviation, (POC) point of care

Keywords: blood glucose measurement, dynamic electrochemistry, hematocrit, interference

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