

Methodology for Quantifying Fasting Glucose Homeostasis in Type 2 Diabetes: Observed Variability and Lability

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Abstract

Background:

Increased glycemic variability is associated with an increase risk of adverse clinical outcomes in diabetes. Central to the understanding of diabetes is glucose homeostasis. “Good” homeostasis is equated to low glycemic variability, and “poor” homeostasis is linked to greater glycemic variability. We have, therefore, developed a method with the aim to objectively quantify the domain of glucose–insulin homeostasis. We have termed this method as Observed Variability And Lability (OVAL).

Method:

Blood samples for the measurement of glucose and insulin concentrations were acquired every 2 min for 120 min from 12 patients with type 2 diabetes mellitus [T2DM; median (range) age 35 (25–47) years and duration of diabetes 7 (2–9) years receiving oral hypoglycemic treatment] and 27 controls [aged 38(30–53) years] with an equal split of genders and equal distribution of body mass indexes. The insulin–glucose time variant data form the boundaries of OVAL, defined as the ellipse enclosing the 95% confidence intervals of the insulin and glucose concentrations plotted on an x – y scatter graph and normalized to ensure equal weighting of insulin and glucose.

Results:

Less precise OVAL homeostasis was observed in subjects with T2DM, by a factor of 4, in comparison with controls [OVAL, T2DM 7.8(3.8) versus controls 1.9(1.0); $p = .0003$]. The assessment remained statistically robust ($p < .001$) with increased sampling intervals up to 8 min.

Conclusion:

The OVAL model is a robust method for measuring glucose–insulin homeostasis in controls and T2DM subjects (available online at <http://www.oval-calc.co.uk>). Deranged glucose–insulin homeostasis is the hallmark of diabetes and OVAL has the capacity to quantify in the fasting state.

J Diabetes Sci Technol 2013;7(3):640–645

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Abbreviations: (CI) confidence interval, (HOMA) homeostatic model assessment, (OVAL) observed variability and lability, (SD) standard deviation, (T2DM) type 2 diabetes mellitus

Keywords: glucose homeostasis, glucose insulin homeostasis, glucose variability, glycemic lability

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