

OBSERVATIONS

Reduced Time Points to Calculate the Composite Index

Since the original publication of the composite (Matsuda) index for the measurement of insulin sensitivity from plasma glucose and insulin concentrations during the oral glucose tolerance test (OGTT) (1), this index has been widely used by investigators throughout the world. According to Scopus, more than 1,000 articles have cited the original article (1) during the last 10 years, and several modifications of this index have been published (2,3). Although the basic idea is to use the plasma insulin and glucose areas under the curve (AUCs), the actual time points at which plasma insulin and glucose levels are measured during the OGTT may be few and the time intervals may not be equal.

In some studies, fewer time points, usually 0, 60, and 120 min or only 0 and 120 min, have been obtained during the OGTT. We show here that calculation of the composite index using these fewer time points agrees well with the original calculation, which was based on five plasma glucose and insulin measurements. Although it is difficult to imagine a reasonable AUC when samples from only 0 and 120 min are available, the simple index below works quite well.

$$\text{ISI}(\text{composite}) = k/\sqrt{(G_0 \times I_0 \times G_{120} \times I_{120})}$$

where ISI(composite) is the insulin sensitivity index, k ($= 10,000$) is a constant that provides numbers that are easy to deal with, G_0 and G_{120} represent the plasma glucose concentrations at times 0 and 120 min, I_0 and I_{120} represent the plasma insulin concentrations at times 0 and 120 min, and $\sqrt{\quad}$ is the mathematical function to calculate the square root. Thus, all of the calculations are based on the concept of the original publication.

Using the data from the original publication ($N = 153$) (1), correlation coefficients were calculated relating whole-body ISI(composite) to 1) the rate of insulin-stimulated glucose disposal (R_d) during the euglycemic insulin clamp and 2) hepatic insulin sensitivity (His) measured with tritiated glucose: $\text{His} = 1,000/\text{HGP} \times \text{FPI}$, where HGP is hepatic glucose production, the primary determinant of fasting plasma glucose level, and FPI is fasting plasma insulin. R_d (or His) and an ISI(composite) calculated from 0, 30, 60, 90, and 120 min (set A); 0, 60, and 120 min (set B); and 0 and 120 min (set C) were significantly ($P < 0.01$) correlated with $r = 0.732$ ($r = 0.670$) in set A, $r = 0.741$ ($r = 0.680$) in set B, and $r = 0.772$ ($r = 0.651$) in set C.

Although ISI(composite) calculated using different time points cannot be compared between different studies, within any given study the index provides a reasonable index of whole-body insulin sensitivity.

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