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Fasting Insulin Concentration Is Highly Correlated with Quantitative Insulin Sensitivity Check Index

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Given that the "gold standard" method for evaluating insulin sensitivity in vivo (hyperinsulinemic euglycemic glucose clamp technique) cannot be routinely applied because of technical reasons, simple methods and indexes were developed and are currently available to assess insulin sensitivity in vivo. Quantitative insulin sensitivity check index (QUICKI) has recently been described and is able to accurately estimate insulin sensitivity from a fasting blood sample. We demonstrated that fasting insulin levels strongly inversely correlated with QUICKI in three different groups: 215 healthy nondiabetic nonobese subjects, 62 nondiabetic obese subjects, and 44 patients with glucose intolerance or type 2 diabetes mellitus. Fasting insulin measurement is a simple way of assessing insulin sensitivity in obese and nonobese humans, with or without glucose intolerance or type 2 diabetes mellitus.

Key Words: Insulin sensitivity; obesity; diabetes mellitus; quantitative insulin sensitivity check index.

Introduction

The hyperinsulinemic euglycemic glucose clamp technique is considered the "gold standard" for quantifying insulin sensitivity in vivo *(1)*. This test is conceptually simple but technically complex, making it difficult to apply in large-scale investigations *(2,3)*. In this context, several methods have been proposed to evaluate insulin sensitivity in vivo, including simple indexes that assess insulin sensitivity from a single sample at diabetes clinics and in large-population studies *(4)*.

Recently, Katz et al. *(3)* described the quantitative insulin sensitivity check index (QUICKI) and concluded that this index is an accurate method for assessing insulin sensitivity from a fasting blood sample. When compared with other methods for estimating insulin sensitivity in vivo, QUICKI had the best overall linear correlation with the "gold standard" clamp measurement *(3)*. Later, many studies confirmed that QUICKI is an accurate index of insulin sensitivity in a variety of other contexts, such as in healthy, obese, and diabetic populations; pregnant women and women with gestational diabetes; subjects with hyperandrogenism; and young girls with premature adrenarche *(5,6)*. However, Duncan et al. *(7,8)* recently did not consider QUICKI a useful index of insulin sensitivity following exercise training.

In the present study, we assessed the values of QUICKI in three different groups—215 healthy nondiabetic nonobese subjects, 62 nondiabetic obese subjects, and 44 patients with glucose intolerance or type 2 diabetes mellitus—and compared these values with homeostatic model assessment (HOMA) and fasting insulin levels.

Results and Discussion

The individuals in the group with glucose intolerance or type 2 diabetes mellitus were older than those in the other two groups. Body mass index (BMI) and glucose differed among all groups. Fasting insulin levels, QUICKI, and HOMA were not different between the obese group and the group with glucose intolerance or type 2 diabetes mellitus. These two groups had higher insulin levels and HOMA index and lower QUICKI than the nonobese group (Table 1). Patients with glucose intolerance (n = 15) and type 2 diabetes mellitus (n = 29) shared similar insulin and QUICKI values. As for correlations with QUICKI, it is worth stressing that fasting insulin levels strongly inversely correlated with QUICKI in all the groups studied (Table 1).

Data from the current study, in agreement with those of Abbasi and Reaven *(9)*, demonstrate that QUICKI and fasting insulin levels are well correlated and may be equally employed for the assessment of quantitative insulin sensitivity in humans. Recently, McAuley et al. *(10)* demonstrated that a weighted combination of two routine laboratory measurements, such as fasting insulin and triglycerides, provides a simple means of screening for insulin resistance in the general population.

Our results provide support for the use of fasting insulin concentration as a form of estimating insulin sensitivity

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Table 1
Clinical and Metabolic Features of Subjects and Correlation of QUICKI with Various Parameters

	Nonobese (n = 215; 160 F/55 M)	Obese (n = 62; 36 F/26 M)	Type 2 diabetes mellitus or glucose intolerance (n = 44; 16 F/28 M)
Age (yr)	39.32 ± 12.30	41.42 ± 13.57	56.11 ± 10.98
BMI (kg/m^2)	24.31 ± 3.07	35.32 ± 4.46	29.98 ± 4.89
Glucose (mg/dL)	87.53 ± 8.36	91.15 ± 7.04	125.9 ± 35.15
Insulin (mIU/L)	7.58 ± 5.33	15.65 ± 8.98	15.27 ± 12.65
QUICKI (1/log Ins + log Gluc)	0.36 ± 0.03	0.32 ± 0.03	0.32 ± 0.03
HOMA (Ins × Gluc/22.5)	30.32 ± 23.60	64.30 ± 39.41	90.34 ± 90.93
QUICKI × HOMA	r = –0.99; $p < 0.0001$	r = –0.98; $p < 0.0001$	r = –0.96; $p < 0.0001$
QUICKI × Insulin	r = –0.98; $p < 0.0001$	r = –0.96; $p < 0.0001$	r = –0.93; $p < 0.001$
QUICKI × Glucose	r = –0.54; $p < 0.0001$	r = –0.46; $p < 0.0001$	r = –0.29; $p = 0.054$
QUICKI × BMI	r = –0.52; $p < 0.0001$	r = –0.31; $p = 0.01$	r = –0.59; $p < 0.0001$

in obese and nonobese humans, with or without glucose intolerance or type 2 diabetes mellitus. In these cases, it may not be necessary to calculate indexes that estimate insulin sensitivity.

Materials and Methods

Informed consent was obtained from each subject. Subjects were referred by their primary physicians to Fleury Medical Diagnostic Center, and these physicians ordered several tests, including measurement of glycemia and insulinemia, and glucose tolerance test. Glucose intolerance was diagnosed based on the criteria recently recommended by the American Diabetes Association *(11)*. Serum insulin levels were measured with an immunofluorimetric assay (Wallac Oy, Turku, Finland, reference values: 2.5–25.0 mIU/L) not susceptible to intact proinsulin crossreactivity. For a mean insulin value of 13.0 mIU/L, inter- and intraassay coefficients of variation (CVs) were 6.70 and 4.65, respectively. For a mean insulin value of 53.2 mIU/L, inter- and intraassay CVs were 4.81 and 2.20, respectively. Statistical analysis included Spearman correlation test to calculate correlations (r) between pairs of indexes of insulin sensitivity and student's *t*-tests to compare differences among various parameters when appropriate. A value of $p < 0.05$ was considered statistically significant.

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