COMMENTS AND RESPONSES

Muscle and Liver Insulin Resistance Indexes Derived From the Oral Glucose Tolerance Test

Response to Abdul-Ghani et al.

It was recently reported (1) that it is important to assess both hepatic and muscle insulin resistance because doing so can lead to different treatment approaches according to the insulin resistance status of each organ. Currently, the hyperinsulinemic-euglycemic clamp is the gold standard for the measurement of liver and muscle insulin sensitivity (2). However, this method is unpractical in clinical practice. For this reason, Abdul-Ghani et al. (1) developed several formulas that were derived from an oral glucose tolerance test (OGTT) for the assessment of both liver and muscle insulin sensitivity in human subjects. These formulas had higher correlation coefficients with clamp data than other classically published indexes derived from either fasting or OGTT measurements (1). However, they were tested in a heterogeneous population with a wide range of BMI measurements (19.9–64.2 kg/m^2), which included both male (1/3) and female (2/3) subjects in whom one-third were glucose intolerant (1).

We tested the muscle insulin resistance index in a more homogeneous population of 113 nondiabetic postmenopausal overweight and obese women (aged 57.7 $\pm$ 0.5 years, BMI 32.4 $\pm$ 0.4 kg/m^2) who were recruited from the Department of Nutrition at the University of Montreal for a weight-loss study (3). This population is at high risk for insulin resistance. The studied patients displayed an OGTT with glucose and insulin measurements and a hyperinsulinemic-euglycemic clamp with an insulin infusion rate of 75 mU/m^2 per min for 180 min, which allowed an estimation of muscle insulin resistance. Correlations were calculated using the Spearman's rank test. We found a significant correlation (rho = 0.542, $P < 0.0001$) between OGTT-derived index from Abdul-Ghani et al. (1) and hyperinsulinemic-euglycemic clamp results expressed as M (milligrams per minute per killograms) divided by I (steady-state insulin concentration). However, this correlation was not higher than those observed with the Stumvoll index (rho = 0.442, $P < 0.0001$), Matsuda index (rho = 0.627, $P < 0.0001$), or a new recently proposed simple index for assessing insulin sensitivity derived from an OGTT (rho = 0.680, $P < 0.0001$), which is calculated as $1/[\text{Log (sum glucose}_{t0 + 30 + 90 + 120\ \text{mmol/l}}) + \text{Log (sum insulin}_{t0 + 30 + 90 + 120\ \mu\text{UI/ml}})]$ (3).

Therefore, although it is probably useful to screen for both liver and muscle insulin sensitivity, it is also important to define the most reliable and simple tool to evaluate insulin sensitivity according to the population investigated. Indeed, such an index might be different according to age, sex, and weight and glycemic status, particularly for muscle insulin sensitivity evaluation.

Jean-Philippe Bastard, md, phd[1,2,3]
May Faraj, phd[4]
Antony D. Karelis, phd[4]
Jennifer Lavasseur, bsc[4]
Dominique Garrel, md[4]
Denis Prud'homme, phd[5]
Remi Rabasa-Lhoret, md, phd[4,6]

From the [1]AP-HP, Hôpital Hôpital Tenon, Service de Biochimie et Hormonologie, Paris, France; the [2] INSERM, U680, Paris, France; [3]Faculté de Médecine, Université Pierre et Marie Curie-Paris 6, UMRS680, Paris, France; the [4]Laboratoire des Dysfonctions Métaboliques, Department of Nutrition, Université de Montréal, Montreal, Quebec, Canada; the [5]School of Human Kinetics, Faculty of Health Sciences, University of Ottawa, Ottawa, Ontario, Canada; and the [6]Centre de Recherche du Centre Hospitalier de L'Université de Montréal, Montréal Québec.

Address correspondence to Rémi Rabasa-Lhoret, MD, PhD, Département of Nutrition, Université de Montréal, Montréal, Québec, Canada. E-mail: remi.rabasa-lhoret@umontreal.ca.

DOI: 10.2337/dc07-0622

References

1. Abdul-Ghani MA, Matsuda M, Balas B, DeFronzo RA: Muscle and liver insulin resistance indexes derived from the oral glucose tolerance test. *Diabetes Care* 30:89–94, 2007
2. DeFronzo RA, Tobin JD, Andreas R: Glucose clamp technique: a method for quantifying insulin sensitivity check index: a simple, accurate method for assessing insulin sensitivity in humans. *Am J Physiol* 85:2402–2410, 1979
3. Bastard JP, Vandernotte JM, Faraj M, Karelis AD, Messier L, Malita FM, Garrel D, Prud'homme D, Rabasa-Lhoret R: Relationship between the hyperinsulinemic-euglycemic clamp and a new simple index assessing insulin sensitivity in overweight and obese postmenopausal women. *Diabetes Metab.* 2007 May 10; [Epub ahead of print]