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Effect of Hyperinsulinemia on Urea Pool Size and Substrate Oxidation Rates

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Abstract

Recently, indirect calorimetry has frequently been used together with hyperinsulinemic clamps. With few exceptions, however, no attention was paid in these studies to the possible effects of hyperinsulinemia on urea nitrogen (*N*) pool size and the consequences of such changes on the calculated rates of protein, lipid, and carbohydrate (CHO) oxidation. We have determined the effects of euglycemic-hyperinsulinemic clamps on urea N pool size, urinary N excretion, and rates of protein, lipid, and CHO oxidation (measured by indirect calorimetry) in six normal men. Insulin infusion (1 mU · kg^{-1} · min^{-1}) increased peripheral venous insulin concentration from 7 ± 1.2 (mean ± SE) to 51 ±4 μU/ml. Glucose concentration was clamped at 84 ± 1.1 mg/dl. Between 0 (preclamp) and 360 min (end of clamp), blood urea N concentration decreased from 17.2 ± 1.1 to 11 ± 0.8 mg/dl ($P < .001$), and the urea N pool decreased from 604 ± 41 to 388 ± 30 mmol ($P < .001$). The urea N

production rate decreased from 461 ± 91 (preclamp) to 91 ± 63 μmol/min during the last 4 h of the clamp (P < .05). Urinary N excretion remained unchanged (705 ±113 vs. 905 ±125 μmol/min, NS). Correction of urinary N excretion for insulin-induced reductions in the urea N pool resulted in the following changes in substrate oxidation rates (calculated for the last 4 h of the clamp). Protein oxidation rate decreased by 72 ± 8% (from 82.8 ± 10.9 to 25.7 ± 9 mg/min); lipid oxidation rate increased by 66 ± 16% (from 43.6 ± 11.9 to 61.7 ± 12.1 mg/min); and CHO oxidation rate increased by 12 ± 2% (from 167.8 ± 20.4 to 187.7 ± 21.6 mg/min). We conclude that euglycemic hyperinsulinemia decreases the urea N pool. If uncorrected, this will result in substantial overestimation of protein oxidation and underestimation of lipid and CHO oxidation rates.

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