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Letters to the Editor

Re: "Alternative equations for whole-body protein synthesis and for fractional synthetic rates of proteins" by Ramakrishnan (*Metabolism* 2007;56:1550-60)

To the Editor:

Dr Ramakrishnan has evaluated in detail the commonly used algorithms for the estimation of whole-body rate of protein synthesis and amino acid oxidation using isotopic tracers in the steady state. The analyses are helpful for the quantification of protein synthesis and oxidation in vivo. I was surprised by his reference to our work (reference 29) and his comment suggesting that we multiply the formula in their Eq. (7) with isotopic enrichment of the tracer infused, implying an error [1].

The algorithm used in all our work (references [2-5] and others) is the same as in Eq. (7) as described in detail here: rate of oxidation of tracer carbon (X) = $V_{CO_2} \times E_{CO_2}$, where V_{CO_2} = rate of production of CO_2 and E_{CO_2} = ^{13}C enrichment of expired CO_2. This can be corrected for the potential retention of the label C in the bicarbonate pool, as done by Ramakrishnan. The retention factor (0.81) is not the same under all physiologic states [4].

Fraction of the infused tracer oxidized = $(V_{CO_2} \times E_{CO_2})/(I \times E_i)$, where I is the rate of infusion of tracer and E_i is its ^{13}C enrichment.

Therefore, the rate of oxidation of the substrate = $[(V_{CO_2} \times E_{CO_2})/(I \times E_i)] \times R_a$, where R_a = rate of appearance of the substrate in the body (blood) compartment.

Because $R_a = I \times [(E_i/E_p) - 1]$, therefore the rate of oxidation of tracee or $X_{TSS} = [V_{CO_2} \times E_{CO_2}/I \times E_i] \times I[(E_i/E_p) - 1] = V_{CO_2} \times E_{CO_2} \times [1/E_p - 1/E_i]$.

This is the same as Eq. (7) of Ramakrishnan. In our work, we have always presented these algorithms in a stepwise manner so that they are easy to understand, rather than lump them in a single complex equation.

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References

[1] Ramakrishnan R. Alternative equations for whole-body protein synthesis and for fractional synthetic rates of proteins. Metabolism 2007;56:1550-60.
[2] Kalhan SC, Rossi KQ, Gruca LL, Super DM, Savin SM. Relation between transamination of branched chain amino acids and urea synthesis: evidence from human pregnancy. Am J Physiol 1998;275:E423-31.
[3] Assel B, Rossi K, Kalhan S. Glucose metabolism during fasting through human pregnancy: comparison of tracer method with respiratory calorimetry. Am J Physiol 1993;265:E351-6.
[4] Glamour TS, McCullough AJ, Sauer PJJ, Kalhan SC. Quantification of carbohydrate oxidation by respiratory gas exchange and isotopic tracers. Am J Physiol 1995;268:E789-96.
[5] Kalhan SC, Gruca LL, Parimi P, O'Brien A, Dierker L, Burkett E. Serine metabolism in human pregnancy. Am J Physiol Endocrinol Metab 2003; 284:E733-40.

Response

To the Editor:

I appreciate Dr. Kalhan's kind words about my paper [1]. The derivation he provides in his letter is quite correct under the Tracee Steady State assumption, consistent with my equation (7) as he says. However, his formulas here differ slightly from the paper I referred to [2]. In his letter, Dr. Kalhan correctly has (IxEi) in the denominator for fraction of infused tracer oxidized and "I" in the formula for Ra. However, in the 1998 paper [2], both the denominator for tracer fraction oxidized (F) and the formula for Ra have only "I"; the same error is seen in two of the other papers Dr. Kalhan mentions [3,4]. I do see that the formulas are given correctly in one of the references [5]. Apparently, there were typographical errors in the other three articles.

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