

Nutrition Discussion Forum

Energy expenditure by de novo lipogenesis

An interesting discussion concerning *de novo* lipogenesis (DNL) in human subjects has recently appeared in an issue of *British Journal of Nutrition* (Lammert *et al.* 2000). The authors clearly demonstrated DNL by overfeeding with carbohydrate, contrary to the results of studies in which DNL was found to be negligible (Acheson *et al.* 1984). Lammert *et al.* (2000) measured partly hepatic DNL using an isotopic approach (Hellerstein *et al.* 1991) and partly total DNL derived from the amount of fat deposited minus the amount of fat available for storage. However, this estimation of total DNL is questionable, as fat gain was measured by the Impedans method, which is dubious for quantitative determination of fat retention.

Using different methodology Jentsch *et al.* (2000) demonstrated that overfeeding with carbohydrate caused DNL in human subjects similar to that in single-stomached animals. Furthermore, Chwalibog & Thorbek (2000) calculated an energy transfer of 12–17% from carbohydrate to fat metabolism from 24 h measurements of gas exchange in ten adult human subjects consuming to satiation a normal diet of (% energy) 18 as protein, 50 as carbohydrate and 32 as fat.

Having accepted the occurrence of DNL in human subjects, the question of the energy expenditure (EE) due to DNL remains unsolved. Based on stoichiometry EE due to DNL has been calculated to be about 19%, while EE due to transfer from digested fat to body fat is about 3% (Flatt, 1978).

It has always been of great economic interest in animal husbandry to obtain high energy utilization, i.e. low EE, using different feeding regimens. For that reason, numerous experimental studies were carried out during the last century to measure protein and energy metabolism in farm animals. The methodology generally applied has been measurement of N and C balances, including indirect calorimetry based on 24 h measurements of O₂ consumption and CO₂ production. From the C balances, obtained by measurement of C ingested and loss of C in faeces, urine and CO₂, the daily fat retention can be calculated with high accuracy.

With this methodology, the efficiency of metabolizable energy available for fat retention was found to be 75.7%, i.e. 24.3% EE, in pigs fed added amounts of pure nutrients (Schiemann *et al.* 1961). Results from 110 experiments with growing pigs (20–120 kg live weight) fed diets of grain and protein supplied at high or low feeding levels were used in a multiple regression model, and results showed an EE value of 24.8% due to DNL (Thorbek *et al.* 1983). Moreover, in experiments with adult pigs (200 kg live weight) fed an increasing supply of fat EE due to DNL was found to be

21.9%, while for direct transfer from digested to retained fat EE was 9.5% (Kirchgessner & Müller, 1998).

All results from experiments with pigs concerning EE due to DNL are in good accordance, independent of breed, feed regimen or live weight, and in agreement with the stoichiometry. It would be desirable if the same methodology could be applied in experiments with human subjects in order to clarify the value of EE due to DNL in man.

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