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The Effect of Amino Nitrogen on the Energetics of Ruminal Bacteria and Its Impact on Energy Spilling

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The predominant ruminal bacteria that were obtained from a 10^8 dilution of ruminal fluid could be maintained as a mixed population for long periods as long as the bacteria were provided with a complex mixture of carbohydrates. Growth of predominant ruminal bacteria in carbohydrate-limited, ammonia-excess, continuous cultures (0.07/h) had a low requirement for maintenance energy, but the non-growth energy dissipation of ammonia-limited, carbohydrate-excess, predominant ruminal bacteria was approximately 10-fold higher (0.96 vs. 0.09 mg of hexose equivalent/mg of protein per h, respectively). Mathematical derivations indicated that this additional nongrowth energy dissipation could be accommodated by an energy spilling function that was independent of the growth rate. Peptides and amino acids had little impact on the yield of carbohydrate-limited, ammonia-excess, continuous cultures (0.07/h), but amino N greatly increased the growth rate and yield of excess-energy batch cultures. The change in growth rate and yield that was dependent on amino N indicated that the energy-excess batch cultures had the same capacity to spill energy as did the ammonia-limited, carbohydrate-excess, predominant ruminal bacteria (0.80 vs. 0.86 mg of hexose equivalent/mg of protein per h, respectively). When the energy-excess batch cultures were provided with amino N, the growth rate increased, the difference in anabolic and catabolic rates was smaller, and less energy was spilled.

Key Words: ruminal bacteria • peptides • amino acids • energy

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