

THE PREDICTION OF THE RATE OF FOOD INTAKE IN GROWING PIGS

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On a balanced food or one first limiting in energy, a pig can be expected to be seeking to eat at the rate necessary to meet its energy requirement. An immature pig in a thermally neutral environment needs energy for maintenance, growth of its lipid-free body and lipid retention. The prediction of its energy requirement necessarily involved the prediction of the rates of these three processes in potential growth. Across genotypes at maturity, maintenance is proportional to $P_m^{0.73}$ where P_m is mature body protein weight. Across protein weights for a given genotype, maintenance is proportional to P , its protein weight. The energy needed for maintenance is thus $M_E P_m^{-0.27} P$ MJ/day, where M_E is a constant. The energy needed for growth is proportional to the growth rate of protein, dP/dt , and that for lipid retention is proportional to the rate of lipid retention, dL/dt . In potential growth, these rates are $dP/dt = B \cdot P \cdot \ln(P_m/P)$ and $dL/dt = (L_m/P_m)(b + 1)(P/P_m)b(dP/dt)$; L_m is the lipid weight at maturity and

$(b + 1)$ the allometric exponent relating L to P during potential growth. The pig qualities necessary for predicting the rates of maintenance, growth and lipid retention, and hence energy requirement, are P_m , L_m , B and b . The attainment of the potential rates of growth of protein and lipid on a given food leads to a rate of heat production, HP. If the environment is hot HP cannot be lost and potential growth is not attained. If the environment is cold the necessary heat loss HLC exceeds HP and the pig seeks to eat $(HLC-HP)$ MJ metabolizable energy per day more than it would seek in a thermally neutral environment. On a given food, the rate of intake predicted by the above method may exceed the capacity of the pig to eat bulk. On an imbalanced food it will be insufficient to supply the pig with all of its nutrient needs. Intake in these cases can be predicted from data on the pig's capacity to eat bulk, to store excess lipid and to lose excess heat.