Measurements to Predict Barley DE Content

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A range of measurements ((1) physical, (2) chemical, (3) apparent metabolizable energy (AME), and (4) near infrared spectroscopy (NIRS)) was explored to predict digestible energy (DE) content of barley for pigs. The focus was DE, because with least-cost diet formulation the greatest cost pressure is against supply of available energy. Forty barley samples were analyzed for swine DE in 2 trials. Trial 1 included 20 samples without damaged kernels, whereas trial 2 included off-grade (sprouted, frost-damaged) samples. Overall, DE ranged from 2686 to 3163 kcal/kg (90% DM). (1) Density ranged from 47.9 to 71.5 kg/hL and was not correlated to DE (R^2 = 0.14), indicating that physical measurements can not predict DE accurately. (2) Acid detergent fiber (ADF) concentration was the best single predictor for DE in trial 1 (DE=3526 – 92.8 x ADF (90% DM); R^2 = 0.85; P < 0.01), indicating that chemical parameters can predict DE accurately. (3) Barley samples were analyzed by a modified AME-bioassay in broiler chicks, in diets with and without supplemental enzymes. Without enzymes, AME and DE were not correlated (R^2 = 0.18), but correlation improved greatly by enzyme addition (R^2 = 0.56). (4) Ground and whole kernel barley samples were analyzed by NIRS (400-2500 nm, 2 nm intervals). A good calibration was developed using 27 ground samples (R^2 = 0.96; SE of prediction (SEP) = 30.47) to predict DE in 12 other ground samples (R^2 = 0.98; SEP = 24.0), similar to a calibration with whole kernel samples (R^2 = 0.94; SE of cross validation (SECV) = 86.8 kcal/kg).

Implication:
The degree of variation in DE content of barley, like that in other ingredients, hinders precise diet formulation. Together, results indicate that barley DE can be predicted accurately by NIRS and chemical characteristics. To implement NIRS successfully, a larger sample set of barley with determined DE content is required to increase robustness of calibration.