EXCRETA VISCOSITY AS AN INDICATOR OF MICROBIAL ENZYME ACTIVITY IN THE HINDGUT AND AS A PREDICTOR OF BETWEEN-BIRD VARIATION IN AME IN BROILERS

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The apparent metabolisable energy (AME) value of an ingredient is not determined solely by the characteristics of the feed; rather it is a parameter reflecting the interaction between the feed and the animal. Thus, highly variable AME values are found between replicates within the same treatment when a low-ME wheat is fed to young broilers are found (Rogel *et al.*, 1987; Hughes and Choct, 1997). The consequences of this variation are: (a) inaccuracy in least-cost diet formulations, and (b) uneven body weight of broilers at slaughter. Differences in gut morphology of the bird do not seem to offer any explanation for this variation (Hughes *et al.*, 2000). The current study examined whether indicators of microbial enzyme activities could be found to explain the between-bird variability in AME when a low-ME wheat diet was fed to three to four week old broilers.

Day-old male broilers were fed a commercial starter diet to 21d. Then 48 healthy birds were chosen and allocated to a wheat-based AME type diet (Hughes and Choct, 1997) with or without a xylanase. Each diet was replicated 24 times in individual cages. The birds were allowed to adapt to the diets for three days followed by quantitative collection of excreta over four days for determination of the AME values. Fresh excreta (5 g) sub samples were also taken on day 4 for excreta viscosity determination. After the last collection, the birds were killed and their ileal and caecal contents collected. Viscosity was determined using a Brookfield viscometer. Ileal and caecal xylanase and β-glucanase activities were determined as follows: to 2 mL of arabinoxylan or β-glucan solution (with a viscosity of approximately 10mPa.s) 0.2mL of digesta supernatant was added and the mixture was incubated at 37°C for 1h with stirring. The viscosity of the mixture was then determined. The drop in viscosity was taken as an indicator of enzyme activity and the relative enzyme activity was expressed as follows: Enzyme activity = (viscosity of control/viscosity of mixture) x 100.

Xylanase supplementation increased ($P<0.01$) the AME of the wheat from a control value of 12.5 to 13.1 MJ/kg DM and decreased ileal viscosity from 58.6 to 9.5 mPa.s. The current study also measured excreta viscosity as a possible indicator of enzyme activities produced by the gut microflora. Thus, the excreta from the control birds had a viscosity of 14.8 mPa.s, whereas that from birds fed the enzyme-supplemented diet had a viscosity of 4 mPa.s. The significantly lower ($P<0.01$) viscosity values for excreta compared with ileal digesta suggest that the gut microflora of the chicken produce some enzymes capable of degrading non-starch polysaccharides (NSP). Indeed, xylanase and β-glucanase were clearly detectable in the caeca of birds fed both diets. Furthermore, the caecal xylanase activity was significantly correlated ($r = 0.72$; $P<0.001$) with AME, but there was no correlation between caecal β-glucanase activity and AME. Neither enzyme was detectable in the ileum of birds fed the control diet. The AME correlated ($r = -0.81$; $P = 0.001$) closely with excreta viscosity, but did not correlate with ileal viscosity in the current experiment.

It is concluded that the high between-bird variation observed when a low-ME wheat diet is fed to young broilers appears to be related to the ability of the hindgut microflora to produce xylanase. The excreta viscosity may be a usable measurement to predict this variation.

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