Novel *Bacillus* probiotic strains increase the digestibility of wheat by broilers

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Historically, antibiotics have been added to meat chicken diets as growth promotors (AGPs), as they improve gut health. This in turn improves digestion and absorption of nutrients. The global reduction or elimination of antibiotic use has led to a search for feed additives to substitute functionally for antibiotics, hence the interest in probiotics. Probiotics contain bacteria that are beneficial to the gut and have been demonstrated to improve health status of production animals including improved growth performance, protection against intestinal pathogens and enhanced immunity (Bajagai *et al.* 2016). The objective of this feeding trial was to examine the novel *Bacillus* probiotic strains on nutrient digestibility in diets with a higher percentage of wheat (high-xylan). The novel *Bacillus* strains selected for the digestibility bioassay were chosen for their observed digestive enzyme activities, in particular xylanase production levels in cell culture. Although, it is known that enzyme production in fermentation does not necessarily equate to the same enzyme production in the GIT.

Male Ross 308 broilers, were randomly allocated into pens at 28 days post-hatch and offered a wheat (920 g/kg) based bioassay diet that contained celite (20 g/kg) as a source of acid-insoluble ash (AIA), which was used as an indigestible marker. The dietary treatments (1. Control, 2. Commercial xylanase, 3. Commercial *B. amyloliquefaciens probiotic*, 4. Novel QUT produced *B. amyloliquefaciens* probiotic, 5. Novel QUT produced *B. subtilis* probiotic, 6.) were fed to 4 replicate pens (8 birds/pen) for seven days. The probiotics were added at approximately $5x10^9$ spores /kg feed. The mash diets and water were provided *ad libitum*. For the final three days of the experimental period apparent metabolisable energy (AME) was determined by total collection. On day seven, digesta from birds within a pen were pooled for the determination of ileal starch digestibility, and ileal pH was also measured. AME was analysed by one-way analysis of variance (ANOVA) using IMB SPSS Statistics 25, with a p-value of <0.05 denoting a significant difference. Data was adjusted for any mortalities. A Duncan *post hoc* test was used for pairwise comparison of the means. A Pearson correlation was used to determine any similarities between analysed groups. The AME values determined for the dietary treatment groups are displayed graphically in Figure 1. The control without any feed additives had the lowest AME value. Diets with the commercial and QUT produced *B. amyloliquefaciens*, respectively showed similar AME values. The novel *B subtilis* probiotic showed a numerical increase in AME, slightly higher than the positive control xylanase group in diet two. Moreover, Diet 6 showed a significant (P<0.05) increase in AME compared to the other diets. The highest starch digestibilities occurred with the addition of xylanase (Diet 2, 91%) and the novel *B. subtilis* (Diet 6, 92%), but differences between groups were not statistically significant. A Pearson's correlation showed that there was a significant inverse association (P < 0.01) between AME and ileal starch digestibility. Moreover, an inverse relationship between ileal pH and AME was observed.

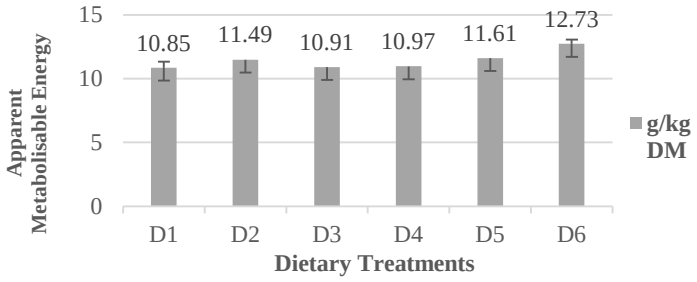

Figure 1. The mean AME (MJ/Kg DM) of the six dietary treatment groups fed 92% wheat diet. The vertical error bars show standard error +/- of the mean group values.

The findings suggest that the novel *B. amyloliquefaciens* and *B. subtilis* do have the capability to improve wheat AME. Evidently, wheat digestibility is improved by the enzymes produced by the dietary inclusion of the novel *Bacillus* sp. Moreover, elucidating the potential of *Bacillus* to increase digestibility of high starch wheat diets would assist in understanding mechanisms of probiotic action and its capability of producing enzyme activity in the poultry intestinal tract.

References

Bajagai YS, Klieve AV, Dart PJ, Bryden WL. (2016) Probiotics in animal nutrition - Production, impact and regulation. Food and Agriculture Organisation of the United Nations.