187 An in vitro investigation into the effect of phytic acid on starch hydrolysis: Novel molecular insights. Luke P. Barnard*[1], Yueming Dersjant-Li[1], Ajit K. Satapathy[2], Sudheendra K. Kumar[2], Naresh B. Koneru[2], Soumyadip Ghosh[2], Luis F. Romero[1], and Ashish Paradkar[2], *[1]Danisco Animal Nutrition–DuPont Industrial Biosciences, Marlborough, United Kingdom, [2]DuPont Knowledge Center, E.I. DuPont India Private Limited, Hyderabad, India.*

The antinutritional effect of phytic acid in feed ingredients is well documented. However, the nature and specific mechanisms for many of these interactions are not yet well defined. In this in vitro study, we investigated the effect of phytic acid on starch hydrolysis and provide mechanistic insights of the interactions. A spectrophotometric starch hydrolysis assay was used to quantify the effects phytic acid on starch hydrolysis. Saturation transfer difference NMR (STD-NMR) and internal tryptophan florescence were used to investigate ligand binding and conformational changes to amylase enzyme structure. There was complete hydrolysis of 250 μg of starch by 5 μg of amylase. Phytic acid inhibited starch hydrolysis, with almost complete inhibition achieved at 5 m*M* phytic acid concentration. The effect was driven through interactions between phytic acid and both starch and amylase. STD-NMR demonstrated that phytic acid was able to bind corn starch, wheat starch but not to a purified starch, maltodextrin. There was no binding of corn starch by phytic acid in the presence of phytase or protease. This could suggest that phytic acid is binding to proteins-associated with starch from grains preventing hydrolysis by amylase. The fluorescence assay showed there were conformational changes in the structure of the amylase enzyme caused by phytic acid addition. These results suggest that phytic acid causes an unfolding of the amylase enzyme and rendering it catalytically inactive. Addition of phytase to the mixture can mitigate the effects, suggesting the interaction is reversible. In conclusion, this work identifies novel mechanistic insights to the way phytic acid inhibits starch hydrolysis and demonstrates that phytase is effective in alleviating the negative effects.

Key Words: phytase, phytic acid, starch, amylase, in vitro

188 Influence of initial body weight, beak trimming, and inclusion of Na-butyrate in the diet on growth performance, body weight uniformity, and digestive tract traits of brown pullets from hatching to 16 wk of age. Nuria Nuñez[1], Guillermo Fondevila[1], Pilar Guzmán[1], Beatrix Saldaña[1], Andrés Ortiz[2], Raúl Rodríguez[3], and Gonzalo G. Mateos*[1], *[1]Departamento de Producción Agraria, Universidad Politécnica de Madrid, Madrid, Spain, [2]Nutega S. L., Coslada, Madrid, Spain, [3]Ibertec S. A. U., Boecillo, Valladolid, Spain.*

The influence of initial BW and beak trimming on growth performance, BW uniformity, and gastrointestinal tract (GIT) traits was studied in brown pullets fed diets supplemented or not with 0.3% Na-butyrate (Butirex C4; Novation 2002 S. L.) from hatching to 16 wk of age. The GIT traits studied were the pH, relative weight (RW, g/kg BW), and fresh contents of the GIT organs and the relative length (cm/kg BW) of the small intestine and cecum, at 5, 10, and 16 wk of age. There were 12 treatments organized as a 2 × 2 × 3 factorial, with the initial BW of the pullets at hatching (34.2 vs. 37.9 g), beak trimming procedure [low (L-0) or high (H-0) intensity of infrared treatment applied at the hatchery, and traditional beak trimming at 8 d of age (F-8)], and inclusion of Na-butyrate in the diet (0 vs. 0.3%) as main effects. No interactions among main effects were detected for any of the variables studied and therefore, only main effects are presented. Growth performance was not affected by the initial BW of the pullets in any of the periods considered. From 0 to 7 wk of age, H-0 pullets had greater ADFI ($P < 0.01$) and ADG ($P < 0.05$) than F-8 pullets with L-0 pullets being intermediate. Also, F-8 pullets showed reduced ADFI ($P < 0.05$) from 0 to 16 wk of age as compared with H-0 pullets, with L-0 pullets being intermediate. Cumulatively (0–16 wk), no differences in ADG or FCR were detected. In general, the inclusion of Na-butyrate improved BW gain of the pullets but the benefits were significant only from 0 to 2 wk of age ($P < 0.005$). Treatment did not affect pullet uniformity or any of the GIT traits studied at any age. In summary, neither initial BW nor beak trimming methods affected pullet weight or GIT development. Supplementation of the diet with Na-butyrate improved pullet growth at the early stages of growth but not thereafter.

Key Words: beak trimming, gastrointestinal tract, initial body weight, Na-butyrate, pullet