Effects of graded levels of phytase on digestibility of nutrients, growth performance, and bone ash in corn and soybean meal-based diets fed to pigs

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ABSTRACT

A novel *E. coli* phytase that is believed to be heat stable was recently developed (Smizyme, Origination, Minneapolis, MN). Two experiments were conducted to test the hypothesis that this novel *E. coli* phytase results in increased nutrient and energy digestibility, increased retention of Ca and P, increased bone ash deposition, and increased growth performance of pigs fed corn and soybean meal based diets. In Exp. 1, a total of 56 growing pigs (initial body weight: 13.6 kg) were randomly allotted to 7 diets. A positive control (PC) diet without phytase was formulated to contain 0.70% Ca and 0.33% standardized total tract digestible (STTD) P. A negative control (NC) diet was formulated to contain 0.50% Ca and 0.16% STTD P; no dicalcium phosphate was included in this diet. Five additional diets that were similar to the NC diet, but contained 250, 500, 1,000, 1,500, or 2,500 units of Smizyme per kg were also formulated. Pigs were housed individually in metabolism crates and fecal and urine samples were collected separately for 5 d after 5 d of adaptation. Results indicated that pigs fed the NC diet had reduced ($P < 0.05$) ATTD and retention of P, Ca, and Zn compared with pigs fed the PC diet. Nitrogen retention and metabolizable energy of diets increased (linear, $P < 0.05$) by increasing the level of Smizyme in the diets. The ATTD and retention of Ca and P increased quadratically ($P < 0.05$), the ATTD of K, Na, Mg, and Zn increased linearly ($P < 0.05$), and the retention of Mg and Mn increased quadratically ($P < 0.05$) as Smizyme inclusion increased in the diets. The concentration of phytase required for maximum retention of P and Ca was greater ($P < 0.05$) than the concentration required for maximum ATTD of P and Ca. In Exp. 2, a total of 60 growing pigs (initial body weight = 11.2 kg) were randomly allotted to 6 diets. Diets were similar to the diets used in Exp. 1 with the exception that the diet containing 1,500 units of phytase was not used in Exp. 2 and monocalcium phosphate was used in the PC diet instead of dicalcium phosphate. Pigs were fed phase I diets during the initial 6 days and phase II diets from day 7 to 27 and fecal samples were collected twice daily from all pigs at the last 2 days of each phase. At the end of the experiment, all pigs were euthanized to collect the 3rd and 4th metacarpals from each front foot. Overall results indicated that pigs fed the PC diet had greater ($P < 0.05$) ATTD of P, bone weight, bone ash, Ca, and P, average daily gain (ADG), average daily feed intake (ADFI), and gain:feed ratio (G:F) than pigs fed the NC diet. Inclusion of increasing levels of Smizyme to the NC diet increased quadratically ($P < 0.01$) the ATTD of P, but not of Ca. Increasing concentrations of Smizyme increased quadratically ($P < 0.05$) bone weight, bone ash, and Ca and P deposition in bone. Smizyme also increased linearly ($P < 0.05$) ADG, ADFI, and G:F during the entire experimental period. In conclusion, ATTD of GE and most macro and micro minerals and retention of Ca and P increased if increased levels of phytase were added up to 2,500 phytase units/kg to corn-soybean meal diets that contained no inorganic P. Fecal excretion of Ca and P was reduced, and retention of Ca, P, and N was increased by adding phytase to the NC diets.