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Effects of exogenous enzymes and particle size on corn energy values for growing pigs

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Objective

The objective of this trial was to access enzyme supplementation potential to improve the digestibility of corn ground at different particle sizes.

Material and Methods

A total of 90 barrows (progeny of Landrace X Large White sows inseminated with Pietrain X Duroc X Large White semen) with 55 kg average initial weight were allotted to individual metabolic cages according to a random block design in a 3 x 3 factorial arrangement of treatments. Blocks were established based on initial weight and ancestry. Cages provided separated urine and feces collection. Animals were allocated to nine treatments (ten replicates each). Treatments consisted of ground corn at three different particle sizes (PS = 540, 810 and 1007 µm of geometric mean diameter) combined with 3 levels of enzymes: control group without enzymes (N); 300 g/ton of α-amylase (A - Ronozyme®A - DSM Nutritional Products); and 300 g/ton of the same α-amylase with 200 g/ton fungal endo-β-glucanase and fungal xylanase (Ronozyme®WX - DSM Nutritional Products). A basal corn and soybean meal diet was formulated to achieve nutritional requirements of pigs, according NRC (1998). Treatment diets were composed of 60% basal diet with 40% ground corn at the particle sizes defined above. Individual feed consumption was calculated based on metabolic weight (live weight ^{0,75}) during twelve days (seven days of adaptation to diets and cages) followed by five days of total urine and feces sampling. Animals had 2 meals per day and fresh water was provided *ad libitum*. Iron oxide was used as fecal marker at 2% level of inclusion in order to define beginning and finishing moments of collection of feces and urine. Samples were sent to lab for dry matter, Nitrogen and energy determinations. Corn digestible (DE) and metabolizable energy (ME) values were determined for individual samples. Data were submitted to ANOVA according to a mathematical model that included main effects of corn particle size and enzyme level and the interaction of both. Means of significant different effects were then compared using Student's t test.

Results

There were no interactions between corn particle sizes and enzyme levels ($p>0.05$). Corn particle size ($p<0.05$) and enzyme level ($p<0.05$) had significant effects on DE (Table 1) and ME (Table 2). Ground Corn at PS of 540 µm increased 4.8% DE and ME mean values of corn when compared to other PS. AX enzyme combination improved DE and ME value for corn compared to control level and A enzyme. The improvement was 2.55%, in average. Pigs can not digest all the polysaccharide fractions of corn and the usage of exogenous enzymes may improve the digestion of non-starch polysaccharides.

Conclusion

These results indicate that lower particle size and exogenous enzymes improve the energy values of corn for pigs. However, particle size effect was more important for the improvement of corn energy value than enzyme supplementation.

Table 1 – Effect of corn particle size and enzyme levels on corn digestible energy (kcal/kg) for pigs.

PS µm	Enzymes levels			
	N	A	AX	Average
540	3456 ± 29	3504 ± 46	3551 ± 49	3504 ± 25[a]
810	3336 ± 31	3327 ± 54	3401 ± 61	3355 ± 29[b]
1007	3280 ± 58	3306 ± 58	3408 ± 68	3331 ± 36[b]
Average	3358 ± 27[b]	3379 ± 34[ab]	3453 ± 36[a]	

Table 2 – Effect of corn particle size and enzyme levels on corn metabolizable energy (kcal/kg) for pigs.

PS µm	Enzymes levels			
	N	A	AX	Average
540	3410 ± 28	3458 ± 47	3500 ± 5	3456 ± 25[a]
810	3293 ± 30	3278 ± 57	3355 ± 63	3309 ± 30[b]
1007	3236 ± 55	3259 ± 59	3369 ± 70	3288 ± 36[b]
Average	3313 ± 26[b]	3331 ± 35[b]	3408 ± 36[a]	