Dose-response effect of 3-phytase from *Aspergillus niger* on the availability of phosphorus and calcium in ducklings

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In plants, phosphorus mainly occurs as phytic acid which is not available for nonruminant animals like poultry (Juin et al, 2001). Phytases like the *Aspergillus niger* 3-phytase or the 6-phytase naturally present in cereals, hydrolyse phytates and make part of the phosphorus available for the animals. The benefit is well demonstrated for broilers, laying hens and turkeys. Some authors have also studied the effect in ducks (Farrell and Martin, 1997 ; Orban et al., 1999 ; Wendt et al., 2003) but data which are available to establish an equivalency table between phytase units and available P from plant source for ducks are limited..

This experiment was designed to study the efficiency of *Aspergillus niger* 3-phytase (Natuphos®) in growing ducks. Phosphorus and calcium retentions were investigated by a dose-response balance trial. Thirty four ten days old male Pekin ducklings were individually penned in balance crates. Birds received during 10 days a restricted quantity (90 g/day in two meals) of a unique pelleted feed (ME 12.3 MJ/kg, total P from plant source 4.2 g/kg, Ca 6.0 g/kg) supplemented with different levels of 3-phytase: 0, 300, 500, 700 FTU/kg. De-mineralised water was given ad libitum. During the five last days of the experimental period, excreta were sampled every day before the morning feeding and bulk-stored for each individual at –18°C. Calcium and phosphorus contents were analysed at the end of the experimental period. For each experimental treatment, retention was calculated as the difference between measured intake and measured excretion. Utilisation is the retention as percent of intake. Birds were weighed at the beginning of the experimental period, 5 days later and at the end. Data were subjected to ANOVA procedures using the software package STATISTICA for Windows 6.0. In case of a significant treatment effect means were compared with the Dunnett-t test. Non linear regression analysis was performed with the program Graphpad Prism 4.0.

Results for the utilisation of plant phosphorus and calcium are shown in table 1. No significant effect of diet on the growth of ducklings was observed. 3-phytase addition significantly reduced phosphorus and calcium excretion ($P<0.001$). Retention and utilisation of these minerals were significantly improved ($P<0.001$). Utilisation of P from the basal diet was 30%. The figure shows the result of the non-linear regression for P utilisation depending on phytase level. P utilisation was best described by an exponential function with P utilisation approaching an asymptote of 60%. As the calcium level in the diet was not limiting in this study and the dietary calcium mostly originated from Ca carbonate, the effect of phytase on Ca utilisation was probably due to the increased amount of P available. “Available phosphorus equivalency values” can be calculated from these data for 3-phytase (table 2).

It can be concluded from this study that 3-phytase from *Aspergillus niger* has the potential to improve P and Ca availability in ducks and that 0.95 g available P can be replaced by 500 FTU of Natuphos® in feeds for growing ducks.

Table 1 Intake, excretion and utilisation of P and Ca in growing ducks fed diets with different levels of 3-phytase.

		Phytase (FTU/kg)				*P*
		0	300	500	700	(ANOVA)
	Number of birds =	*9*	*8*	*7*	*7*	
Phosphorus						
	intake (mg/d)	374	374	374	374	
	excretion (mg/d)	263	196*	182*	164*	<0.001
	retention (mg/d)	112	178*	192*	211*	<0.001
	utilisation (%)	29.8	47.6*	51.4*	56.3*	<0.001
Calcium						
	intake (mg/d)	541	541	541	541	
	excretion (mg/d)	353	228*	174*	188*	<0.001
	retention (mg/d)	188	313*	367*	353*	<0.001
	utilisation (%)	34.7	57.8*	67.9*	65.3*	<0.001

*means showing an asterisk are significantly different (P<0.05) from the unsupplemented control according to Dunnett t-test

Figure Effect of 3-phytase supplementation on P utilisation in ducks.

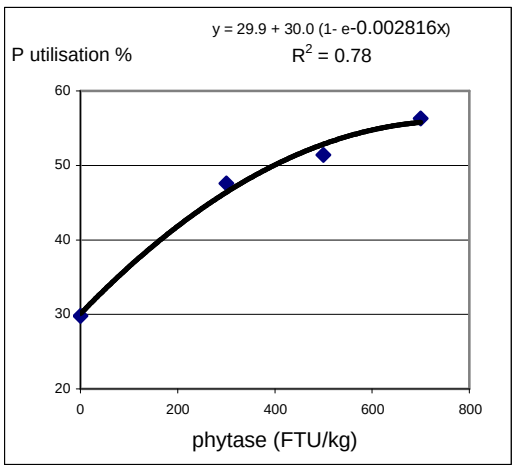

Table 2 Equivalency of phytase in ducks at different levels of supplementation (after calculation)

Phytase (FTU / kg)	Av. P (g)	Av. P (g/100 FTU)
100	0.31	0.31
200	0.54	0.27
300	0.72	0.24
400	0.84	0.21
500	0.95	0.19
600	1.02	0.17
700	1.05	0.15

References

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