

## Monogastrics

The monogastric's mechanism for digestion of phosphorus varies quite substantially between pigs and poultry.

In pigs, most phosphorus is absorbed from the small intestine in the form of orthophosphate, with absorption predominantly occurring in the jejunum and duodenum where its solubility is greatest.

The phosphorus is then transported across the gut wall. Its subsequent fate is influenced largely by the amount absorbed in relation to the animal's requirement.

<b>General phosphorus requirements for monogastric animals</b>			
	Digestible P in the feed (% as fed)		Apparant available Pin the feed (% as fed)
<b>Pigs</b>		<b>Poultry</b>	
Piglets	0.4	Broiler	0.41 - 0.28
Fattening pigs		Layers	0.34 - 0.31
· < 50kg	0.3	Broiler breeders	0.30 - 0.25
· 50–100kg	0.24	Pullets	0.36 - 0.14
Sows		Turkeys	0.63 - 0.31
· lactating	0.32	Ducks	0.51 - 0.27
· pregnant	0.25		
Source: CEFIC (NB: These figures must be interpreted by nutritionists in order to adjust them to the nutritional specifications of the diet)			

The kidney plays the major regulatory role in controlling phosphorus levels and any phosphorus excess is excreted primarily via the urine. When animals are fed below their requirement they are able to reabsorb phosphorus in the kidney by more than 99%. Excess phosphorus to that needed for optimum production and growth is deposited in the skeleton where it benefits skeletal integrity.

In poultry, potentially available phosphorus solubilises in the gizzard where it becomes available for absorption in the form of ortho-phosphate. Absorption starts in the duodenum and jejeunum, due to the absorptive capacity of the intestinal mucosa and prevailing intestinal pH conditions.

However, the retention time of the chyme is too short for complete absorption here and phosphorus continues to be absorbed to a decreasing extent further down the small intestine.

## **Phosphorus requirements**

Phosphorus requirements primarily take into account performance levels, age and genotype. These are usually expressed as digestible phosphorus in the case of pigs and available phosphorus in the case of poultry.

Dietary allowances are normally calculated to meet the animal's requirement, allowing a safety margin of 5-10% to take into account variations within the flock or herd, fluctuations in feed intake and to compensate for the fact that the requirements are not updated in line with livestock progress.

Allowances increasingly are based on calculations of phosphorus digestibility, but the safety margin should nevertheless not be underestimated, since phosphorus levels that are consistently lower than the animal's requirement can cause irreversible damage.

Without this phosphorus, the animals' requirements would not be met.

## **Field experience**

Legislation in The Netherlands in the 1990s to reduce phosphorus waste resulted in a reduction in the total amount of dietary phosphorus permitted in feed compounds.

However, field observations showed that reductions in phosphorus levels of the order of 20% - 25% had an adverse effect on the performance of broiler breeding stock during the rearing and production stages, as well as on broilers and commercial layers (van Tuijl, 1998).

Among the effects were increased mortality; a greater number of leg problems, including bone breakage in layers; poorer egg quality in layers and breeders; and reductions in uniformity in broilers and young broiler breeding stock.

Increasing the dietary phosphorus levels by 10-15% on the farm, combined with good management conditions and low pressure from disease, resulted in animal performance returning to normal levels.

This underlines the necessity for any reduction in mineral levels in the feed, including phosphorus, to be closely monitored under field conditions.