Gut friendly feeding to boost pig performance

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Modern pig nutrition increasingly has to realise that feeding pigs in a cost efficient way is not a simple function of the nutrient specification of the diet.

A lot of research was done to determine nutrient requirements of pigs for different production stages and different genotypes.

The focus was on feeding for performance. How can we feed a pig to make it grow faster and leaner to produce more offspring in a production life? Less thought was spent on feeding for pig health.

With the excessive use of antibiotics in pig diets the consequences of this were less severe.

However, by 2006 all antibiotics will be banned from use in animal diets in the EU.

Nutritional support

Antibiotics cure a lot of symptoms but, in many cases, they do not really get down to the cause of pig health problems and it is more effective to support the pig's endogenous defences against disease by nutritional means.

The intestinal tract is often the first line of defence for the body and acts as a defence system in several ways:

- The resident micro-flora, which protects against invading bacteria.
- The intestinal wall cells which not only absorb nutrients, but also provide a protective barrier to the entry of harmful substances.
- The gut immune system which is made up of specialised immune cells. Therefore, the gut is very important to proper immune system development.

Gut micro-flora balance

The balance of the gut micro-flora plays an essential role in the health of the animal. Imbalances in the gut micro-flora will lead to symptoms such as MMA and diarrhoea.

Furthermore, it will lead to decreased performance in general, as a result of decreased immune function and efficiency of nutrient utilisation.

So, nutritionists should not only be concerned about the pig's nutrient requirements but also about the requirements of the beneficial gut bacteria when formulating diets for health and performance.

Or, even better, find ways of selectively supporting the beneficial gut bacteria, whilst depriving potentially harmful bacteria in the gut.

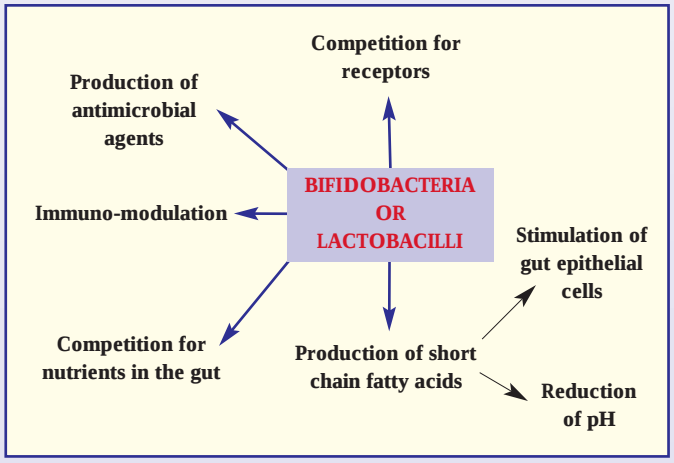
So, how can we selectively support the beneficial gut bacteria?

Amongst the generally recognised species with beneficial effects are bifidobacteria and lactobacilli which will stimulate gut immune functions, aid the absorption of nutrients and synthesise vitamins of the B group.

Furthermore, they will inhibit the growth of potential pathogens in the gut (Fig. 1).

Therefore, it is important to support and stimulate their growth to sustain healthy animals.

Fig. 1. Inhibitory effects of bifidobacteria and lactobacilli on pathogenic bacteria in the gut (modified from G. W. Tannock 2002).



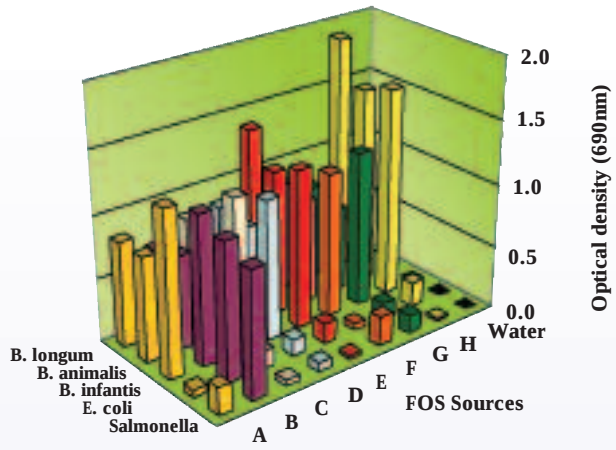


Fig. 2. Growth response of bifidobacteria and E. coli and salmonella measured in optical density (OD) after 16 hours of incubation to different sources of prebiotics in vitro. Biomin Klimitsch et al. (2000).

Positive manipulation

The principal substrates for gut bacterial growth are dietary carbohydrates that have escaped digestion in the upper gastrointestinal tract.

In addition, amino acids can also be effective as growth substrates as well as bacterial secretions, lysis products, sloughed epithelial cells and mucins.

By adding substances to the animal's diet, which can only be utilised by the beneficial gut bacteria, it is possible to selectively feed them in favour of unwanted gut bacteria and thus manipulate the gut micro-flora in a positive way.

Substances which cannot be hydrolysed or absorbed by the animal's digestive system in the upper part of the gastrointestinal tract, but will selectively feed bifidobacteria and lactobacilli, are classified as prebiotics.

There are different sources of prebiotics commercially available but not all of them are of the same quality in terms of selective feeding of gut bacteria as simple in vitro tests in the laboratory reveal (Fig. 2).

Inulin and oligofructose are the classic prebiotics being used in human and animal diets. They are indigestible carbohydrates present in many vegetable foodstuffs.

The chicory plant Cichorium intybus is frequently used as a source for the industrial production of inulin. Inulin is a compound of fructose oligosaccharide and polysaccharide chains.

The chemical composition of inulin extracted from chicory is G(F)n, where n can vary from 12 to 60 (G = glucose and F = fructose). Shorter chains of fructo-oligosaccharides are termed oligofructose.

Available energy source

The fructose molecules in inulin and oligofructose are linked to each other by β (2-1) glycosidic bonds which cannot be hydrolysed by the pigs's endogenous enzymes in the gut.

They are, therefore, indigestible to the pig but available for use as an energy source by bifidobacteria and lactobacilli who can ferment them to short chain fatty acids (SFA) in the colon.

A study where different species

Continued on page 38

Continued from page 37
of bifidobacterium were screened for the ability to grow on fructo-oligosaccharides (FOS) revealed that animal strains of bifidobacteria grew best on short chain FOS.

The use of prebiotics

There is extensive evidence that prebiotics alter the intestinal micro-flora and mucosal immune status in humans and rodent models and that consumption of prebiotics decreases the incidence and duration of enteric disease.

In humans the dosage of FOS to achieve a significant increase in bifidobacteria in the gut has been reported to range between 8-15g per day. For sows in pregnancy this would equate to about 0.32-0.6% of the total daily feed intake and in lactation 0.13-0.25%.

A number of studies have attempted to determine the effects of prebiotics on intestinal microbial populations in pigs.

Some positive effects were seen in weaner piglets (35 days) at an inclusion of 0.2% of the diet.

Also in neonatal piglets a dosage of 0.3% in the diet tended to enhance bifidobacteria concentrations in the gut by day six of life.

However, a study carried out in growing pigs including 0.75-1.5% FOS into the diet suggested no positive effects on gut microflora and decreased feed intakes.

Trials measuring the effects of prebiotics on performance in pigs have shown positive effects on body weight gains and reduced incidence of diarrhoea in response to 0.25-0.5% FOS in the diet. In pregnant sows a level of 0.38% showed a positive effect on weaning oestrus intervals and litter size.

Synergistic effects

Essential oils are volatile liquid substances produced by aromatic plants which can be extracted by water distillation. There are essential oils from certain herbs and spices which have known beneficial effects on digestion when added to the diet.

As a result of the positive effect on digestion they not only improve nutrient utilisation of the animal but also indirectly help to control the gut micro-flora.

The better the nutrients in the diet are digested by the animal the less nutrients will be available to bacteria residing in the colon to grow and multiply.

Thus, by combining prebiotics with essential oils in sow diets a synergistic effect can be achieved in minimising the growth of pathogenic bacteria in the gut and optimising growth of beneficial gut bacteria and, therefore, support sow health and performance in a natural way.

Conclusion

In conclusion, the use of FOS (below 1%) in pig diets has shown improvements in weight gain and health status of pigs, however the effects have been found to be highly variable according to the type of FOS employed, production stage of the animal and conditions for husbandry.

Therefore, there is a need for more research to determine the efficacy of prebiotics in pig production.

Biomin tested a combination of prebiotics with essential oils in sow diets at the University of Kingsville in Texas, USA with positive results on sow performance in lactation. ■

References are available from the author on request.