The successful use of chestnut tannins in pig nutrition

Tannins are a group of plant secondary compounds which have been known and used by man for centuries. Tannins have long been considered 'anti-nutritional' factors in monogastric nutrition, shown to reduce feed intake and palatability, growth rates and feed efficiencies.

by Chunjuan Tang, Nicola Panciroli, Yafeng Zhang, Silvateam Spa, China. www.silvateam.com

However, tannins form many structurally diverse groups and each structural change may alter their impact and interaction of the feed with the animals. The tannins have traditionally been divided into two groups: the condensed and the hydrolysable tannins. Hydrolysable tannins (HT) are made up of a carbohydrate core whose hydroxyl groups are esterified with phenolic acids (mainly gallic and ellagic acid).

The condensed tannins (CT) are non-branched polymers of flavonoids units (flavan-3-ol, flavan-3,4-diol), and usually have a higher molecular weight than the HT (1000-20000 Da compared to 500-3000 Da).

Many of the available studies on pigs focused solely on the impacts of condensed tannins, which are found in a few forage legumes, faba beans, lupins and also sorghum.

However, recent studies revealed that compared with condensed tannins, hydrolysable tannins (HT) appear to have far less impact on growth performance.

Besides their anti-nutritional properties, lots of tannins have been shown to possess certain anti-bacterial, anti-viral anti-diarrheic and antioxidant properties.

In the first weeks after weaning, piglets frequently experience diarrhoea and low weight gain due to the relative immaturity of their gastrointestinal and immune system.

Sometimes the nursery pig will have a similar experience because of the terrible environment and changing diet. So, we added more antibiotic growth promoters and ZnO in feed to control diarrhoea and dyspepsia. But since 2006, the use of antibiotic growth promoters has been prohibited in the European Union, and in 2017 the Chinese government published new announcements to limit using AGP and ZnO in feed.

The search for natural alternatives

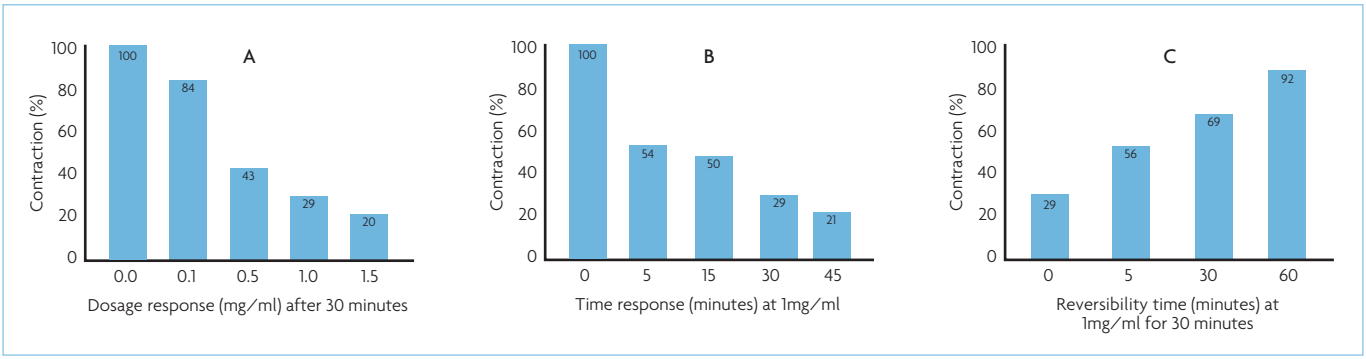
Extensive research has been done over the last couple of decades to search for natural alternatives to in-feed antibiotics, and plant compounds (or phytogenic compounds) have been identified to have a great potential. Among them, plant tannins have received considerable attention and are probably the most studied compounds. Dietary supplementation with tannins might reduce the incidence of diarrhoea in piglets, and some biological properties of tannins are similar to ZnO, so lots of people are paying more attention to tannins as an alternative to in-feed ZnO.

Sweet Chestnut (Castanea sativa Mill) wood extracts, rich in hydrolysable tannins (HTs), are traditionally used in the tanning and textile industries, but recent studies suggest additional uses, especially in animal nutrition. Tannins have shown numerous biological activities which are important to modern food animal production.

Sweet Chestnut tannins can affect gut motility and improve intestinal health. Chestnut tannins slow down the gut peristaltic movements because of its antispasmodic effect. When we added chestnut tannins in feed we found that piglet diarrhoea incidents were reduced, the faeces

Continued on page 10

Fig. 1. The antispasmodic effect of chestnut tannins. A. Contraction-response after exposure to Silvafeed Nutri P within 30 minutes at different dosages. B. Contraction-response after exposure to Silvafeed Nutri P (1mg/ml) within 5, 15, 30 and 45 minutes. C. Contraction-response after exposure to Silvafeed Nutri P (1mg/ml within 30 minutes) and following washing time after 5, 30 and 60 minutes.



Continued from page 9
became drier and, finally, body weight and FCR improved.

The antispasmodic effect of chestnut tannins was assessed in the ileum and colon of guinea pigs, evaluating the tissue contraction rate induced by carbachol (CCh).

The maximum effect of chestnut tannins was reached within 30 minutes incubation at 1.0mg/ml. The inhibition was totally reversed after 60 minutes of tissue washout (Fig. 1).

Tannins generate a thin layer on the digestive tract surface and thus reduces inflammatory incidences. Tannins can reduce intraluminal fluid accumulation by: antisecretory activity; promoting reabsorption of water and decreasing intestinal motility.

The other important character of tannins is that they inhibit specific bacteria replication and their cytotoxic effect, while improving the selective growth of Lactobacillus and Bifidobacterium.

Chestnut tannins, tested in vitro, have proven a strong bacterial inhibition against the most pathogenic bacterial strains such as Salmonella gallinarum, Pasteurella multocida, Salmonella typhimurium, Escherichia coli and Clostridium perfringens (Table 1, Fig. 2).

Chestnut tannins can be helpful to control salmonella infections, in combination with hygienic and other protective measures.

When tested in infected flocks the tannins showed a reduction of Salmonella spp. presence and, consequently, a decrease of the environmental contamination of Salmonella spp.

Generally, anti-microbial activity of tannins against Gram-positive bacteria has been reported to be greater than against Gram-negative bacteria. Naturally occurring plant polyphenols have long been recognised as effective antioxidants.

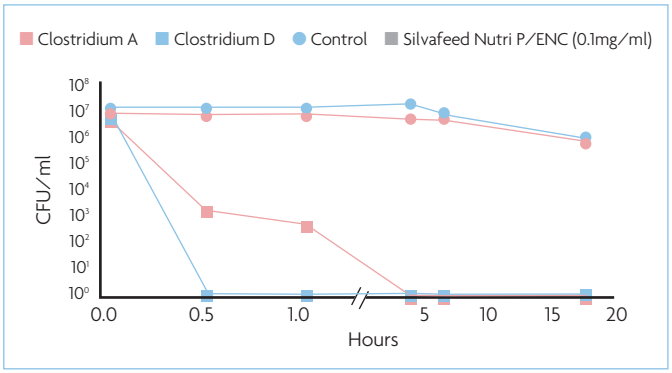


Fig. 2. Chestnut tannins inhibit Clostridium A and Clostridium D in vitro.

Wide application

The antioxidant property of tannins has a wide application in the food industry and medical field to prevent oxidative stress related diseases such as cardiovascular disease, cancer or osteoporosis. The number of hydroxyl groups and the degree of polymerisation of tannins are considered to be correlated with their abilities to scavenge free radicals.

Tannins with the most hydroxyl groups are most easily oxidised and therefore possess the greatest antioxidant activity. Tannins can also be used as an antioxidant in animal nutrition. The addition of chestnut tannins might inhibit lipid peroxidation and increase antioxidant enzymes activities in plasma and liver of transition dairy cows.

Chestnut tannins improved meat quality traits of heat-stressed lambs, in the same way, it reduced the negative effects and the study also showed inhibitory effects on lipid peroxidation in lamb meat.

Tannins have been shown to have significant activity against some viruses, for example, human immunodeficiency virus (HIV), bovine adeno-associated virus and noroviruses.

All the above information demonstrates that tannins possess varying biological activities and it might be a wonderful alternative to in-feed antibiotics and ZnO for pigs.

Silvafeed P is a natural feed additive especially developed for livestock, obtained from a selection of tannin-rich plants, and containing 75% hydrolysable tannins. ■

Table 1. Intestinal pathogen inhibition.

Strains	Bacterial concentration (CFU/ml)	Silvafeed concentration (mg/ml)	Pre-incubation time (hours)	Inhibition
Staphylococcus aureus	$1.2x10^{9}$*	1.0	24	Inhibited
Campylobacter jejuni	$1.2x10^{9}$*	1.0	24	Inhibited
Salmonella typhimurium	$1.0x10^{7}$	1.0	24	Inhibited
Escherichia coli	$1.8x10^{6}$	1.5	6	Inhibited
Clostridium perfringens	$1.8x10^{6}$	1.5	6	Inhibited

References are available from the author on request