The successful use of chestnut tannins in poultry nutrition

Tannins are a group of plant secondary compounds which have been known and used by man for centuries. Tannins have traditionally been divided into two groups: the condensed and the hydrolysable tannins.

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The condensed tannin can be extracted from the heartwood of the quebracho (Schinopsis lorentzii) and black wattle bark (Acacia mearnsii). The condensed tannins can not be broken down in the intestine. The hydrolysable tannins can be divided into gallotannins and ellagitannins.

The gallotannins release gallic acid when hydrolysed, the Chinese gallnut is an important source of this tannin.

Ellagitannins are characterised by a glucose core esterified with at least one hexahydroxy diphenyl acid moiety, which is formed by oxidative coupling between two gallic acid units.

These substances can be degraded in the digestive tract of animals to ellagic acid, then to castalin and finally to the gallic acid and glucose or other monosaccharides.

In fact, the oldest applications of tannins is leather tanning. For a long time, tannins were considered antinutrients that reduced digestibility and consequently, growth performance in monogastric species.

Antibiotics for growth promotion in farm animal production have been used for several decades and proved to be effective in increasing animal and poultry production efficiency.

But in recent years, the potential risk of generation and transmission of resistance led to the banning of the use of antibiotics as growth promoters in determined countries.

For example, in 2006 the European Union banned the use of antibiotic growth promoters (AGP) in animal feeding.

The Chinese government has shown the newest policy about using AGPs in farm animal feed.

The search for natural alternatives

Extensive research has been done over recent decades to search for natural alternatives to in-feed antibiotics, and plant compounds (or phytogenic compounds) have been identified to have great potential.

Among them, tannins have received considerable attention and are probably the most studied compounds, especially for farm ruminants. Recent studies in veterinary medicine mention that these effects are reflected in better growth performance in different species of food production animals.

Tannins are also able to reduce the risk of livestock disease and transmission of zoonotic pathogens in a sustainable and environmentally friendly manner. Recent reports of the use of tannins in poultry show promising results.

The so-called tannic acid, generally obtained from sweet chestnut (Castanea sativa) aqueous extract, is a typical product containing hydrolysable tannins. It is known for its ability to have beneficial effects.

The intestinal mucosa conditions of a farm bird. A: normal for a 28-day-old bird; B: with Nutri-P.

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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 [mg/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.

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on human health through the expression of some biological activities, related to its antimutagenic, anticancer and antioxidant properties.

Chestnut tannins have been reported to possess antioxidant, antimicrobial and anti-inflammatory capacities for livestock. Tannins also possess anti-spasmodic effects and delay gastrointestinal transit by suppressing intestinal motility.

**Effect on gut motility**

Isolated guinea pig ileum and proximal colon segments were used to evaluate the ability of the tannins to inhibit contractions evoked by agonists such as carbachol (CCh).

Chestnut tannins slow down the gut peristaltic movements because of its antispasmodic effect (Fig. 1). In the digestive tract, the tannins may form a thin film of insoluble, denatured proteins covering the surface of mucous membrane of intestine walls. The thickness of the layer depends on the concentration of tannin in the diet. This phenomenon can explain both protective and inhibitory functions of tannins as a factor against colonisation of intestinal mucosa with pathogens and harmful bacteria (see photograph on previous page).

**Antimicrobial property**

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).

Table 1. Intestinal pathogen inhibition.

<table>
<thead>
<tr>
<th>Strains</th>
<th>Bacterial concentration (CFU/ml)</th>
<th>Silvafeed concentration (mg/ml)</th>
<th>Pre-incubation time (hours)</th>
<th>Inhibition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Staphylococcus aureus</td>
<td>1.2x10^9</td>
<td>1.0</td>
<td>24</td>
<td>Inhibited</td>
</tr>
<tr>
<td>Campylobacter jejuni</td>
<td>1.2x10^9</td>
<td>1.0</td>
<td>24</td>
<td>Inhibited</td>
</tr>
<tr>
<td>Salmonella typhimurium</td>
<td>1.0x10^7</td>
<td>1.0</td>
<td>24</td>
<td>Inhibited</td>
</tr>
<tr>
<td>Escherichia coli</td>
<td>1.8x10^7</td>
<td>1.5</td>
<td>6</td>
<td>Inhibited</td>
</tr>
<tr>
<td>Clostridium perfringens</td>
<td>1.8x10^7</td>
<td>1.5</td>
<td>6</td>
<td>Inhibited</td>
</tr>
</tbody>
</table>

Clostridium perfringens is considered an important poultry pathogen that is the causative agent of necrotic enteritis and subclinical disease. Chestnut tannins can efficiently inhibit the A and D of Clostridium perfringens isolated from poultry (Figs. 2 & 3).

The antioxidant property of tannins has wide application in the food industry and medical field to prevent oxidative stress related diseases, such as cardiovascular disease, cancer or osteoporosis. Chestnut tannins might inhibit lipid peroxidation and increase antioxidant enzymes activities in plasma and liver of transition dairy cows. The addition of chestnut tannins improved growth performance and jejunal morphology in heat-stressed broilers.

The results further showed that dietary chestnut tannins supplementation ameliorated the intestinal inflammatory response and improved the intestinal microflora, barrier function and antioxidant capacity in heat-stressed broilers. All the above information demonstrates that chestnut tannins possess varying biological activities that might be a wonderful alternative to in-feed antibiotic growth promoters and enhance the performance of the poultry industry.

References are available