KEMIN

FAQ (Frequently Asked Questions)

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Tannins

What are tannins?

Tannins are a structurally diverse group of polyphenolic molecules which are commonly found in plants such as sorghum grains, tree woods, gallnuts and fruits.[1,2] Despite their highly variable chemical and physical properties, a unifying property of tannins is their ability to bind proteins, which is why they are traditionally used in the production of leather.[1]

How are tannins classified?

Tannins are often classified based on their molecular structure into two major groups: condensed and hydrolysable tannins.

Condensed Tannins:

Condensed tannins (CTs), also referred to as proanthocyanidins, are the most common type of tannin found in forages.[3] The base structural units of CTs are flavan-3-ols such as catechins, epicatechins and gallocatechins (Fig. 1A). Simple catechin units are often found in wines and green tea, but in general, CTs tend to have higher molecular weights (1,000 to 20,000 Da) and are only degraded under strong oxidative or acidic hydrolysis conditions.[3]

Hydrolysable Tannins:

Hydrolysable tannins (HTs) are named due to their susceptibility to hydrolysis into smaller units following acid, base or esterase treatment. HTs are typically lower in molecular weight (500 to 3,000 Da)[3] and contain a glucose core molecule, which is esterified with phenolic acids.[2] Among HTs, two sub-classes exist based on the esterified phenolic acid units: gallotannins (Fig. 1B) – which are found in tara pods, gallnuts and *Quercus infectoria* plants – and ellagitannins (Fig. 1C) – which are commonly found in chestnut wood.[2] Tannic acid – a gallotannin – is an example of a model hydrolysable tannin.

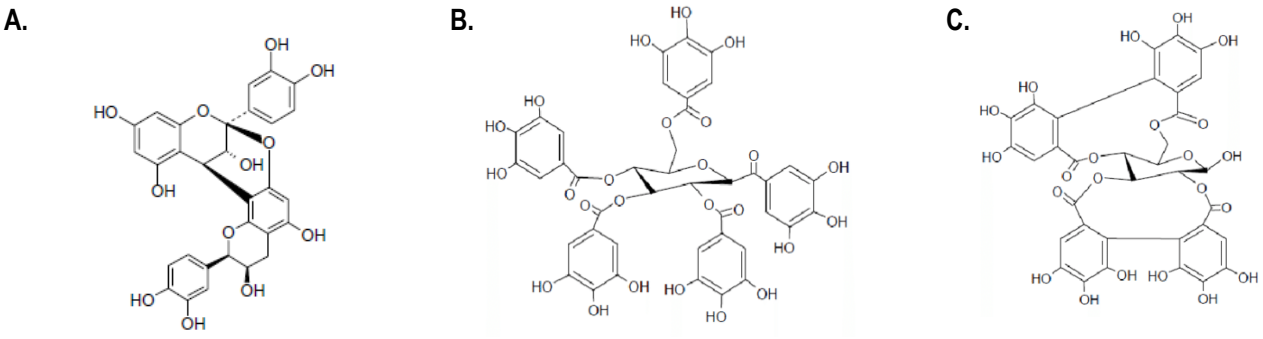

Figure 1. Structures of condensed and hydrolysable tannins: A) proathnocyanidin[1], B) gallotannin[4] and C) ellagitannin[4].

What benefits can tannins offer poultry?

Tannins offer multiple benefits to support the intestinal health of poultry. First, due to their polyphenolic structure, tannins act as potent antioxidants as well as anti-inflammatory molecules. For example, application of tannins has been reported to reduce oxidative and inflammatory stress in colon tissue.[5] Tannins are also astringent, meaning they may help to tighten junctions between intestinal epithelial cells, thereby preventing leaky gut syndrome. Tannins have also been reported to positively modulate the intestinal microbiota compostion[2] and may help to maintain mucosal immunity. The development of bacterial resistance to tannins is postulated to be difficult due to the complex structure of the tannin molecules.

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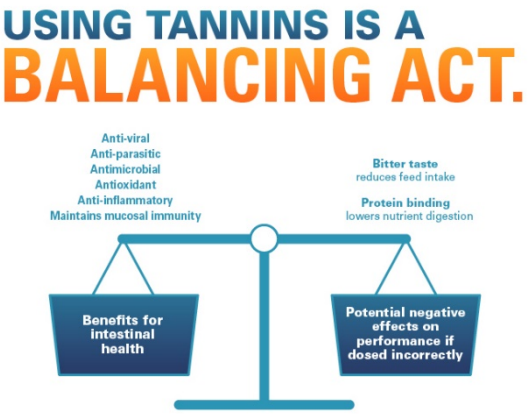
In summary, tannins offer numerous potential benefits for poultry intestinal health. This has led to increased interest in using tannins as potential antibiotic alternatives[2,3] for managing enteric diseases – like coccidiosis[6] – in antibiotic free poultry production systems.

Do tannins have any antimicrobial characteristics?

Research suggests that tannins may exert both antimicrobial and anti-parasitic effects due to their ability to complex with microbial enzymes and/or metal ions.[7,8,9] Specifically, tannins may prevent bacterial growth and proliferation through inhibition of extracellular bacterial enzymes or tannin complexation with metals, such as iron, that are required for bacterial growth.[8] Tannins may also form complexes with nutrients and inhibit their availability to parasites for normal growth, development and motility, thereby decreasing the metabolism of the parasite directly through inhibition of oxidative phosphorylation or electron transport.[9] *In vitro* studies have indicated that both CTs and HTs can inhibit the growth of fungi, yeasts and bacteria,[1] such as *Campylobacter* spp.,[2] *Salmonella* spp.[2] and *Clostridium perfringens*.[10]

Are tannins considered anti-nutritive when used in poultry diets?

Recent research suggests that both the level of dietary tannin, the tannin source and tannin structure impact the nutritive or anti-nutritive properties of the tannin.[1] In general, anti-nutritional effects of tannins are linked to tannin protein binding which may decrease digestibility of feed ingredients such as proteins, carbohydrates and starches.[1,11] Many studies showing the anti-nutritional effects of tannins utilized diets either with high concentrations of tannins or diets containing purified condensed tannins from sorghum.[2] Alternatively, feeding low levels of hydrolysable tannins has been shown to have beneficial effects on intestinal health and performance of poultry.[1,10]



In summary, using tannins in poultry is a balancing act. Choosing the right tannin, at the right level, at the right time is crucial to ensure the benefits of tannin-based feed additives are realized.

References

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