

Effects of Tannin on Feed Intake, Body Weight Gain and Health of Goats

Sebsibe Amesa and Mastewal Asfaw

Alage Agricultural Teaching Vocational and Educational Training College, Ethiopia

Abstract: Plants consumed by herbivores contain nutrients to meet animals' nutrient requirements, but they also contain chemical defenses to discourage herbivore such as plant secondary compounds (PSCs). Plant secondary compounds are compounds that are not involved in the plant primary metabolism, thus they are produced by the plant but not used by the plant for its functions such as production and growth. However, PSCs can inhibit the growth of microbes and fungi and they are often referred to as defenses. All woody species contain potential toxic or digestibility reducing PSCs, including tannins. Tannins are complex polyphenolic compounds with the molecular weights in range of 500-20000 Daltons. The terms "tannins" encompasses diverse oligomers and polymers. Tannins are widely distributed throughout the plant kingdom, especially in trees, shrubs and herbaceous leguminous plants. Condensed Tannin reduces voluntary feed intake, body weight gain and digestion of nutrients as well as health of goats, therefore additional work is recommended on the effects of tannin in different animal species.

Key words: Tannin • Goat • Feed Intake • Body Weight Gain

INTRODUCTION

In animal production, nutrition is one of the most important factors, being determinant to productive performance. Consequently, the understanding of ingestive behavior and particularly dietary choices and adaptation to pastures, is of extreme importance in livestock management. Differences among free-grazing ruminant species, concerning food selection allow an efficient pasture use at the habitat scale. Additionally, an effective and sustainable animal management, as well as ecological and environmental aspects, would benefit from a well-founded knowledge on animal-plant interactions [1].

The interaction is affected by plant secondary compounds. Plant secondary compounds are compounds that are not involved in the plant primary metabolism. However, plant secondary compounds can inhibit the growth of microbes and fungi and they are often referred to as defenses [2].

According to Barry *et al.* [3], secondary compounds can exert both anti-nutritional and nutritionally beneficial effects upon forage feeding value of goats. PSMs comprise a wide range of chemicals, such as tannins [4].

Tannin refers to "Tanning" or preservation of skins to create leather and tannins also contribute to the

astringency of many popular drinks, for example tea and wine. Their role in plant metabolism is not known, although several hypotheses have been advanced, but effects on ruminant digestion are becoming increasingly clear. Tannins bind to proteins in the rumen, reduce protein degradation and when dietary crude protein (CP) concentrations exceed animal requirements for CP, these effects can improve performance. However when dietary CP concentrations are low and fiber concentrations are high, tannins are nearly always detrimental. Beneficial and detrimental effects of dietary tannins for sustainable goat production impact on digestion of goats [5]. There for the main objective of this short review offers the evidence that effects of tannin on voluntary feed intake, body weight gain and health of Goats

Feeding Behavior of Goats: In a study Sicelo Phumlani Dlodla [6] Goats often spend a lot of time selecting high quality material if the feed offered or available is of low quality. Due to this selective process, the intake is sometimes low.

In study Iason [7] cattle and sheep are seen as grazers, whereas goats behave as intermediate feeders. Under natural conditions, goats are generally active, selective, walk long distances in search for feed and choose a diet based in foraging grass. However, under

resource limiting conditions goats will become heavy browsers of trees and shrubs and less discriminating in their grazing habits, due to the reduced supply of available herbage. On the other hand, sheep are less selective and use pasture more effectively when quality plants are available, but in harsh environments their productivity decreases greatly.

Effect of Tannin on Feed Intake: According to Garry Waghorn [8], tannin is one of the non-toxic plant compounds; which reduce feed palatability, feed intake, slow down digestion and develop conditioned aversions. However, the absence of the significant relationship between tannin concentration and intake of browses, pellets and lucerne signifies that tannin concentration did not affect the intake.

High concentrations of tannins reduce voluntary feed intake and nutrient digestibility, whereas low to moderate concentrations may improve the digestive utilization of feed mainly due to a reduction in protein degradation in the rumen and a subsequent increase in amino acid flow to the small intestine. These effects on nutrition are reflected in goat performance [3].

According to Barry *et al.* [3], studies tropical tannins can depress intake. The depressions may the higher the tannin concentration the greater the depression of voluntary feed intake and provide a note of caution with regard to on preference trials as a means of predicting longer term intakes of tannin rich forages.

It would appear that the consumption of plant species with high tannin contents (Generally > 50 g per kg of dry matter, DM) significantly reduces voluntary feed intake, while medium or low consumption (< 50 g kg⁻¹DM) not affect in feed intake [8].

Effect of Tannin on Body Weight Gain: In African savannas, goats consume a diet that contains a large number of plants which contain condensed tannins. Tannins affect voluntary feed intake and digestibility of proteins there by can affect the body weight gain of goats. Mechanisms which affect the body weight gain when tannin are consumed are not well defined [9]. Goats given low tannin concentration diets would lose less body weight than those fed high Concentration of Tannin concentration diets [10, 11].

The body weight gain decreased with the increasing tannin concentrations in the diet. According to Silanikove *et al.* [11], tannins reduce the body weight gain

because of reduction in protein digestibility. Furthermore, the reduction in growth is the function of interaction of tannin in the diet with food proteins, digestive enzymes and microbes.

Similarly tannin reduces the body weight through the reduction of feed intake. However, it is still not clear whether this happens through the reduction in palatability or digestibility. It has been studied by Silanikove *et al.* [11]. The low body weight gain of goats after feeding tannin rich diets is because of the low protein, dry matter and organic matter digestibility. It can be concluded that tannin affect the body weight gain through different mechanisms depending on the duration of goats' exposure to tannin.

Effect of Tannin on Health: Tannin is known to have an ability to reduce the number of internal parasites. The beneficial effects of the plants which are rich in tannin on internal parasites could be due to one, or a combination, of factors. Firstly, tannins may form non-biodegradable complexes with protein in the rumen, which dissociate at low pH in the abomasum, to release more protein for metabolism in the small intestine of goats. This indirectly improves host resistance and resilience to nematode parasite infections. Secondly, tannins may have a direct anthelmintic effect on resident worm populations in animals and thirdly, tannins and/or metabolites in dung may have a direct effect on the viability of the free-living stages [5]. Many experiments have shown that faecal egg count (FEC), parasite numbers or migration is reduced by tannin containing feeds such as cassava leaves, *Acacia brevispior*, *Desmoniumovalifolium*. The lowest level of nematode parasites (Number of eggs/g faeces) was obtained when confined goats were supplemented with cassava leaves [11]. According to Do Thi Thanh Van [9], increasing levels of cassava hay in the diets decreased the number of Nematoda eggs and *Coccidia* oocysts in the faeces, but had no effect on the number of *Cestoda* eggs.

Ruminants grazing forage diets are subject to a number of diseases, some of which have a nutritional component. Two such conditions are rumen frothy bloat in cattle and internal parasite infections in young grazing sheep, cattle, deer and goats.

Bloat is caused by very high solubility of forage proteins leading to the development of stable foam in the rumen and is very prevalent in cattle fed on legumes, especially in spring [12]. Because of their protein-precipitating properties; grazing tannin containing

legumes has long been known to eliminate bloat [13]. However, the minimum plant Condensed tannin concentration needed to make forage bloat-safe was not known; this has recently been proposed to be 5 g CT/kg DM or greater [7].

Effects of tannin on parasitism can be assessed by grazing animals on legumes that contain differing levels of Condensed Tannin but have similar morphology and are similar in other aspects of chemical composition. Anthelmintic treated (i.e., parasite free) lambs grew at similar rates when grazing Condensed Tannin -containing legumes (*Sulla* and *Lotus pedunculatus*) or *non-Condensed Tannin* -containing, However, non-drenched (i.e., parasitized) lambs grew much better on the CT-containing legumes, indicating that they could better tolerate the parasites. Parasite burdens at slaughter were similar for lambs grazing *Lotus pedunculatus* and *sulla*, but were considerably lower for lambs grazing *sulla*.

Two possible mechanisms could be involved. Firstly, improved Essential Amino Acid supply from the action of the CT may counteract the protein loss caused by gut parasitism and may stimulate the immune system, enabling the animals to better resist a parasite burden. Secondly, the CT may directly react with and inactivate parasite larvae during passage through the gut. Using *in vitro* studies [14], have shown that CT extracted from sainfoin, *sulla*.

Lotus pedunculatus and *Lotus* inhibit infective gut worm larvae of sheep and both gut worm and lungworm in farmed deer, with the effect influenced by both CT concentration and structure. Therefore, it seems that CT may counteract parasites by one or both of the above mechanisms and that the mechanism involved may differ for *sulla* and *Lotus pedunculatus* tannin.

CONCLUSION

It can be concluded that consuming tannin contained feed can affects in body weight gain and voluntary feed intake through different mechanisms depending on the duration of goats' exposure to tannin. high concentrations of tannins reduce voluntary feed intake and nutrient digestibility, whereas low to moderate concentrations may improve the digestive utilization of feed mainly due to a reduction in protein degradation in the rumen and a subsequent increase in amino acid flow to the small intestine and also reduces the body weight

gain after feeding tannin rich diets is because of the low protein, dry matter and organic matter digestibility. Tannin is known to have an ability to reduce the number of internal parasites.

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