

Popular Article

Effects of various plant extracts on ruminant health for sustainable livestock development

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Abstract

Despite the fact that many animal products are comparatively rich in nutrients when matched to other diets, but the overuse and abuse of many drugs, particularly antibiotics in animals, is a factor in the growing issue of antibiotic resistance. Furthermore, the widespread use of synthetic chemicals in a variety of agricultural and livestock sectors creates risk to the environment, human health as well animal health. To combat this, bioactive compounds or plant secondary metabolites (PSM) through the several plant extractions are looked on as natural substances that can take the place of antibiotics and such synthetic chemicals as secure and enduring substitutes. According to latest scientific research, there is a tremendous opportunity for using plants to improve animal productivity especially in ruminants. This article discusses the use of various plant extracts as feed additives in ruminants and their impact on livestock production performance.

Keywords: Animal health, Plant extractions, Plant Secondary Metabolites (PSM), Ruminants

Introduction

People have employed plants for their therapeutic qualities throughout history. Although in ancient times the emphasis of this application has frequently been on human health only, but now a day, medicinal value of plants continues to be applied in ethnoveterinary therapies and the management of animal health. As we all are aware about the hazards related to environment, human and animal health due to the extensive use of artificial chemicals in different agriculture and livestock sectors. It is now unlawful to use of excess antibiotics in livestock field as it significantly increases the chance of humans contracting bacteria with antibiotic resistance through animal products. Therefore, such actions have heightened the need to identify natural alternatives to synthetic chemicals and antibiotics, and research has once more focused on using plant extractions as natural bioactive components to enhance animal health.



The reduction of antimicrobials use has raised interest in herbal plant products such as tannins, essential oils, saponins, and similar substances as an alternate methods of controlling rumen fermentation. Plant extracts positive benefits are linked to how they affect microbial fermentation. According to one theory, they create dietary protein complexes that bypass the rumen and shield them from microbial fermentation. When the complexes break down in the acidic environment of the abomasum, proteins become available to the animal (Salem *et al.*, 2012). Essential oils primary effects in the rumen causes a slowdown in protein, starch degradation as well as suppression of amino acid breakdown, which helps the animals for higher degree of digestion and absorption of microbial proteins in small intestine. This may be due to their selective action on specific rumen microbes. Protozoa and end products of rumen fermentation are also being positively impacted by saponins, although these effects are partly uneven because other microbial populations have emerged that can degrade saponins in the rumen. Consequently, these different plant extracts have the ability to be used as rumen modifying agents for sustainable livestock development by replacing antibiotic growth promoters and other pharmaceuticals. In this article we explained about the impact of plant extracts on rumen fermentation constraints, gut health and immunity status of dairy calves.

1. Impact of plant extracts on health and immunity status of dairy calves

We already know that so many plant extracts promote rumen fermentation more effectively in adult dairy animals. Nevertheless, the impact of plant extracts on the welfare and performance of dairy calves has given mixed findings. These variations are probably due to different plant types, numerous extraction techniques, dietary compositions, supplemental dosages and animal circumstances. Now few recent studies found that some significant effects in calves regarding this plant extraction uses. Jahani-Azizabadi *et al.* (2022) observed that inclusion of a blend of phytobiotic-rich herbal extracts (monoterpene hydrocarbon and sesquiterpene hydrocarbon-main plant secondary metabolites) to dairy calf milk may improve various health and immunological issues by reducing the frequency of diarrhea and boosting the prevalence of specific cellulolytic bacteria in the rumen. This is one of the alternatives of administering antibiotics at sub therapeutic dosages in order to boost the health and immunity level of the calf.

2.Effects of plant extracts on rumen fermentation in adult ruminants

Plant extracts enhanced ruminal development and nutrient digestion because plant secondary metabolites (PSM) had a favorable impact on rumen microbe's activity and PSM accelerate protein metabolism and mitigating methane generation (Patra *et al.*, 2006). It has been proved that certain active ingredients of herbal plant extracts, including *Fructus Ligustri Lucidi*, *Crina Ruminants* and *Radix*



Codonopsis increase the effectiveness of fermentation process in ruminants (Qiao *et al.*, 2013). Abd'Quadri-Abojukoro *et al.* (2022) reported that ethanolic extracts of various plant materials can manipulate rumen microorganisms to promote effective rumen fermentation by inhibiting the growth of gram-positive bacteria. The saponin-rich seed pulp of *Sapindus mukorossi*, the tannin-rich leaves of *Populus deltoides* and *Mangifera indica*, the tannin- and essential oil-rich bud of *Syzygium aromaticum* and the essential oil-rich bulb of *Allium sativum* are just a few examples of plants that have the potential to control methanogenesis in ruminants. Tannins have a stronger impact on rumen metabolism when added to hay-based diets, as its lower acetate to propionate ratio and ruminal protein degradation (Menci *et al.*, 2021). The end products of rumen fermentation and nutritional digestibility were improved by fresh amla fruit, which also boosted milk production and milk nitrogen utilisation (Tilahun *et al.*, 2022).

3. Effects of plant extracts on worm load of ruminant GI tract

A significant barrier to the performance of animals is mainly helminthes infestation. The fundamental issue cause due to the infection of ruminant gastrointestinal tracts with parasitic worms, significantly negative impacts on farm output and the farmer's economy. Hoste *et al.* (2022) reported that utilization of such plants, forages and legumes containing tannins as active bio component which manage and control the gastrointestinal nematodes in ruminants. But the beneficial level of tannins in the diet is varies greatly, so its threshold level should be decided to have a significant impact on productivity of animals. Kimani *et al.* (2014) conducted a study on ruminants with herbal extract comprising *Prosopis juliflora* and *Entada leptostachya* concluded that this herbal mixture consequently had the potential to be a new anthelmintic medicine for gastrointestinal infection in ruminants due to its secure and adequately active components. Some recent studies on various extractions from plants containing plant secondary metabolites as active components and their significant impacts on ruminants are compiled in **Table 1**.

Conclusion

The use of synthetic chemicals such as antibiotics in agricultural and livestock sectors now poses a threat to environment and animal health. Plant secondary metabolites extract are natural alternatives to synthetic chemicals and antibiotics which improves the performance and health of ruminants and helps in sustainable development of livestock. However, further study with different concentration of plant extract will be needed which might help for well understanding of animal health performance under different conditions.



Table 1. Effects of different plant extracts on ruminants

Plant Species	PSM* (Active Component)	Animal Species	Effects	References
Mixture of phytobiotic-rich herbal extracts	monoterpene hydrocarbon and sesquiterpene hydrocarbon	Calf	Improve health and immunity level by reducing the frequency of diarrhea and boosting specific cellulolytic bacteria in the rumen	(Jahani-Azizabadi <i>et al.</i> , 2022)
Amla (<i>Phyllanthus emblica</i>) fresh fruit	Vitamin C, Flavonoids and Hydrolysable tannins	Lactating dairy cows	enhanced milk production and milk nitrogen utilisation	(Tilahun <i>et al.</i> , 2022)
Legume family (Fabaceae)	Condensed tannins	Cattle	manage and control the gastrointestinal nematodes in ruminants	(Hoste <i>et al.</i> , 2022)
Whole-seed fenugreek powder combined with natural essential oil	Saponin and essential oil	Cattle	an improvement in energy efficiency and rumen ammonia nitrogen proportion	(e Silva <i>et al.</i> , 2021)
Quebracho and a mixture of quebracho and chestnut	Tannins	Sheep	reduces acetate to propionate ratio and ruminal protein degradation	(Menci <i>et al.</i> , 2021)
<i>Entada leptostachya</i> and <i>Prosopis juliflora</i>	terpenoids, flavonoids, saponins and phenols	Sheep	new anthelmintic medicine for the treatment of gastrointestinal parasites	(Kimani <i>et al.</i> , 2014)

PSM*- Plant Secondary Metabolite



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