ACTA SCIENTIFIC NUTRITIONAL HEALTH

Volume 3 Issue 5 May 2019

Review Article

Antinutritional Factors in Feed and Fodder used for Livestock and Poultry Feeding

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Received: March 04, 2019; **Published:** April 10, 2019

Abstract

Plants which are grown as a fodder for animal feeding purpose is the base feed stuff for animal feeding which provides nutrients and energy. The presence of toxic substances limits the utility of the leaves, pods and edible twigs of shrubs and trees as a animal feed and fodder. Different roughes, legumes, shrubs,herbs, trees and other non-traditional feed of animal contain some anti-nutritional componenta in green as well as in its dry matter basis. Antiquality stuff is regarded as a class of toxic compounds, which are generally not lethal. Toxic components like Nitrate, Mimosine, Tanin, Oxalate, Sinogen, Saponins and BOAA and others are harmful for ruminants, nonruminant and other animals including wild animals. These substances when consumed by animals in large quantities, they not only diminish animal productivity but also cause toxicity during periods of scarcity or confinement. Feeding of such toxin containing feed and fodder above critical limit is fatal, and its regular use even at below level reduced the growth, production, reproduction and quality of milk, meat and egg. In India more scarcity of green fodder so proper precaution includes physical and chemical treatment before feeding, quantities and methods of use may help to overcome from the problem.

Keywords: GDP- Grass Domestic Products; HCN- Hydro Cyanic Acid; PEG- Polyethylene Glycol

Introduction

Livestock plays an important role in Indian agriculture and rural economy. Rural population has major livelihood sources and income from livestock and poultry by selling milk, meat and egg. Livestock contribes 9% and 25% to National GDP and agricultural GDP respectively and contribution from livestock is about 15-20% to the farmers household income. At present, the country faces a net deficit of 45.1% green fodder, 21.9% dry crop residues and 64% in terms of concentrated feeds [1]. In India the available natural fodders are poor in quality with regards to energy, protein and minerals and vitamins which leads to reduces production which directly effects farmers income. The farmers investing about 70% of total cost of milk production on feed, fodder and concentrates only, thus good quality of green fodder having sufficient nutritive value are the demand of the day due to more demand of milk. Although, green fodder, hay and silage contains good nutritional values, but there maintenance, ways of consumption and presence of some toxic material also alarm us. Among the different quality controlling aspects anti quality materials/substances are also of prime importance [2].

Nutrition play major role by driving the functioning efficacy, efficiency and production system of livestock production system. Reduce feeding cost, improve products quality and diminish the impact of production on environment are main challenges nowadays in ruminant production. Feeding cost can be reduced by feeding unconventional feedstuffs and reduced methane emission which have environmental impact as well. Herbs and shrubs in less rain fall areas combat desertification, mitigating the effect of drought, allowing soil fixation an enhancing the restoration of the

vegetation and the rehabilitation of forest and grasslands. In goat and sheep browsing tree foliage plays an important role in many tropical and Mediterranean environments around the world. In arid and semi- arid zone they are abundantly found as good, cheap sources of nitrogen and energy, which may reduce feeding cost and raise sheep and goat productivity. So exploitation of available conventional as well as unconventional feedstuffs in systematic way will increase productivity with minimum loss of ecological diversity. However, the problems of feeding such plants or shrubs (*Acacia, Leucaena and Atriplex*) that they had different levels of anti-nutritional factors [3].

Anti-nutritional factors

Chemical substances present in the diet which by themselves or their metabolic products arising in the system interfere with the feed utilization, reduce production or affects the health of the animal.

They are also called as toxic factors or incriminating factors. Anti-nutritional factors present in various feed/fodder are given in Table 1. Toxic substances of natural origin can be classified based on their chemical properties and on the basis of their effect on utilization of nutrients.

S. No.	Antinutritional/ Toxic substances	Fodder crops
1	Nitrate	Sudan Grass, Pearl millet, Oats
2	Oxalates	Paddy straw,Guinea Grass, Bajra and Hybrid Napier, Setaria Grass, Kikyu & Buffel grass
3	Saponins	Lucerne
4	Tannins	Fodder tree/Shrubs
5	Cynogens	Sorghum, Sudan grass, Jhonson grass
6	Glucosinolates (Goitrogens)	Cabbage, Turnips, Rapeseed and Mustard green
7	Mimosine	Subabul
8	β-N-oxalyl-L-α, β-diamino propionic acid (β-ODAP or BOAA)	Lathyrus

Table 1: Anti-Nutritional factor in forage crops.

According to their chemical properties

Group I: Proteins

1. Protease inhibitor
2. Haemagglutinins (Lectins)

Group II: Glycosides

1. Saponins
2. Cyanogens
3. Glucosinolates (Goitrogens) Or thioglucosides

Group III: phenols

1. Gossypol
2. Tannins

Group IV: Miscellaneous

1. Anti-metals
2. Anti- vitamins

On the basis of nutrients that are affected directly or indirectly

Substances depressing digestion or metabolic utilization of proteins:

- Protease inhibitor (Trypsin and Chymotrypsin inhibitor)
- Haemagglutinins (Lectins)
- Saponins
- Polyphenolic components

Substances reducing solubility or interfering with the utilization of Minerals:

- Phytic acid
- Oxalic acid
- Glucosinolates (Thioglucosides)
- Gossypol

Substances increasing the requirements of certain vitamins:

- Anti-vitamin A,D,E,K.
- Anti-vitamin $B_{1,}$ $B_{6,}$ B_{12} and Nicotinic acid.

Group – I: Proteins

Protease inhibitors:

- Substances that have the ability to inhibit the Proteolytic activity of certain digestive enzymes eg. Legume seeds such as Soyabean, Kidney bean and Mung bean.
- Protease inhibitors are concentrated in the outer part of the cotyledon mass.
- Two types of Protease enzymes inhibitors:
- Kunitz inhibitor (inhibits only Trypsin)
- Bowman–birk inhibitor (inhibits Trypsin and Chymotrypsin)
- The inhibitory substances are mostly heat labile and thus proper heat treatment inactivates the protease inhibitors.
- Trypsin inhibitor of Soyabean interferes with the availability of Methionine from the raw Soyabean.
- Young chicken fed raw Soyabean developed hypertrophy of the pancreas and this is not observed in large animals such as Pigs, Dog and Calves.
- The factors controlling Trypsin inhibitor destruction are
- Temperature
- Duration of heating
- Particle size
- Moisture level
- The trypsin inhibitor activity of solvent extracted Soyabean Meal was destroyed by exposure to steam for 60 min, or by autoclaving under the following conditions i.e. 5 psi for 45 min, 10 psi for 30 min or 15 psi for 20 minutes.

Haemagglutinins (Lectins)

- Soybean, castor bean (ricin) and other legume seeds contain haemagglutinins.
- These are found in both plant and animal tissue.
- These toxic substances combine with the glycoprotein components of RBC causing agglutination of the cells
- Ricin is toxic. It causes severe inflammatory changes in the intestine, kidney, thyroid gland etc.
- Lectins are resistant to digestion by pancreatic juice.
- Lectins are resistant to dry heat but are destroyed by moist heat (steam).

Group – II: Glycosides

Saponins

- These are glycosides characterized by bitter taste, foaming in aqueous solution and haemolyse RBC.
- Their toxicity is related to their activity in lowering surface tension in ruminants.
- The important forages which causes saponin poisoning of livestock are Lucerne, soybean etc.
- The saponin content of the leaves is twice as much as that of the stems and will decline as the plant becomes older.
- Poultry are more susceptible than Pigs. 0.4- 0.5% saponin in the feed decreases feed consumption, egg production and body weight loss in birds.
- Saponins are degraded by rumen microbes and hence, no growth depression takes place. However, upon excess feeding of green Lucerne, saponins lower the surface tension of ruminal content leading to accumulation of gas in the digesta. This condition is known as bloat or tympany or tympanitis.

Saponins are glycosides containing a polycyclic aglycone moity of either C27 steroid or C30 triterpenoid attached to a carbohydrate. The structural complexity of saponins results in a number of chemical, physical, and biological properties, which include foaming, emulsifying, sweetness, bitterness, pharmacological and medicinal, haemolytic properties, as well as insecticidal and anti-microbial activities. Saponins reduce the uptake of certain nutrients including monosaccharide and cholesterol at the gut through intra-lumenal physico-chemical interaction. Hence, it has been reported to have hypocholesterolemic effects [4]. Sharma., *et al.* [5] Observed that 4-7 weeks of ad lib. feeding of Albizia stipulate (Siris) gave rise to toxic manifestation of sheep. A resinous shrub, broom breed (Gutierrezia sarothrae), the toxicity is due to its saponin content. Symptoms include anorexia, listlessness, gastroenteritis and weight loss. In non-ruminants (chicks and pigs), retardation of growth rate, due primarily to reduction in feed intake, is probably major concern [6]. Saponins are among several plant compounds which have beneficial effects. as antibacterial and anti-protozoal properties.

Precaution

Repeated washing with water reduces saponin content and makes the feed more palatable reducing the bitterness associated with saponins [7]. Incorporation of other legumes and roughes in ration along with siris leaf (which are toxic to animal) reduces the saponin toxicity.

Cyanogens

- Cyanide in trace amounts is present in the plant kingdom.
- It occurs mainly in the form of cyanogenic glycoside.
- These glucosides are hydrolyzed to Prussic acid or hydrocyanic acid by enzyme present in the same plant or while being digested by animals.
- There are three distinct glucosides
- Amygdalin found in Almonds.
- Dhurrin found in Jowar and other immature grasses.
- Linamarin found in Pulses, Linseed and Cassava.
- Ruminants are more susceptible to HCN poisoning than horses and pigs since the enzyme required for the release of HCN is destroyed in horses and pigs by gastric HCl.
- It usually causes reduced growth, poor feed efficiency and result in death if consumed in increased amounts. Cattle and buffaloes are more susceptible than sheep.
- Feeding of immature jowar green fodder should be avoided to prevent HCN poisoning.

HCN Concentration in (ppm)		Potential Effect on Livestock	Remarks
Dry Matter	Fresh Harvested		
0-500	0-100	Forage is generally safe and should not cause toxicity.	Safe to Use
500-1000	100-200	Potentially toxic and forage should be fed at restricted rate in the diet.	Dangerous
>1000	>200	Very dangerous to livestock and will usually cause death.	Toxic/ Poisonous

Table 2: Prussic acid (HCN) Concentration in forages [8].

Cyanogens are glycosides of a sugar or sugars and cyanide containing aglycone. Enzymes found in the cytosol which can hydrolye cyanogens and release HCN which is toxic. Damage and toxicity to the plant occurs when the enzymes and glycoside form hydrocyanic acid (HCN). In the rumen hydrolytic reaction can take place by microbes. Hence, ruminants are more susceptible to CN toxicity than non- ruminants. In the liver enzyme Rhodanese rapidly detoxified absorbed HCN and converts CN to thiocyanate (SCN). Excess cyanide ion inhibits the Cytochrome oxidase which stops ATP formation, and further tissues suffer energy deprivation and death follows rapidly [9]. In Cattle and Sheep, the lethal dose of HCN is 2.0-4.0 mg per kg body weight, respectively.

The lethal dose for cyanogens would be 10-20 times greater because the HCN comprises 5-10 per cent of their molecular weight of the substance. Forage containing HCN consumed within a few minutes and simultaneous HCN production would have to be rapid for toxic effect in the body. Young seedlings contains more HCN level than in matured seedlings. Bahrani MJ., *et al*. [10], reported that in the first cut the forage prussic acid percentage is more than the second cut, probably due to degradation of the acid and a higher metabolic activity of the plant due to higher temperatures during growth processes which can reduce the prussic acid accumulation, these low amounts of FPAP (Forage Prussic Acid Percentage) are not toxic to animals.

Precaution

Forage grown on energy stress condition and crop not get proper irrigation, the levels of HCN is found higher in younger sorghum crop. Thus try to avoid these type of crop for feeding livestock. Post-harvest wilting and drying of Cynogenic leaves may decrease the effect of cyanide poisoning. Sorghum, Sudan and Johnson grass must be dried at least six hour before its use for feeding to livestock. More than 200 ppm in fresh green fodder and more than 1000 ppm in dry fodder HCN concentration is toxic. Before feeding, proper drying, ensiling and maturity of fodder reduces the HCN concentration.

Glucosinolates:

- Most plants of Crucifera family (Cabbage, Turnips, Rapeseed and Mustard green) contain these substance.
- These are responsible for the pungent flavours present in plants belonging to the genus Brassica.

- Ruminants appear to be less susceptible compared to pigs and poultry.
- Their main biological effect is to depress the synthesis of the thyroid hormone (Thyroxine, T_4) and Tri-idothyronine (T_3) producing Goiter.
- Glucosinolates occur in the root, stem, leaf and seed and are accompanied by the enzyme Myrosinase (Thioglucosidase), which is responsible for their hydrolysis.

Group – III: Phenols

Gossypol

- Gossypol is present in pigment glands of leaves, stem, roots and cotton seed and cake.
- It is highly toxic to simple stomach animals.
- Pigs and rabbits are more sensitive than poultry.
- Horses are resistant.
- Ruminants are more resistant due to the formation of stable complexes with soluble protein in rumen, which is resistant to enzymztic breakdown.
- Gossypol form complex with metals like iron and the toxic effect can be overcome by supplementing iron as ferrous sulphate.
- Gossypol can occur either in free form or as a gossypol protein complex.
- New varieties of cottonseed with less than 0.01% total gossypol (0.002% in free form) are available.
- Physiological effects of Gossypol includes:-
  1. Reduced appetite
  2. Loss of body weight
  3. Accumulation of fluid in the body cavities
  4. Cardiac irregularity
  5. Reduced O_2 carrying capacity of the blood (reduced HB content)
  6. Adverse affect on certain liver enzymes
- In poultry, it causes:
  1. Decreased growth in chicks.
  2. Decreased egg production
  3. Decreased hatchability
  4. Yolk will turn olive green color

Tannins

- It is a Polyphenolic substance with molecular weight greater than 500.
- The term tannin was coined by sequin in 1796.
- Two types of Tannins:-
  1. Hydrolysable tannins
  2. Condensed tannins

S. No.	Feed/Fodder	Tannin (%)
1	Sorghum	2.0 to 10%
2	Salseed meal	9.0 to 12%
3	Mango seed kernel	5.0 to 7.0 %
4	Mustard oil cake	2.5 to 3.5%
5	Lucerne meal	0.1 to 3.0 %

Table a

Hydrolysable tannins

These can be readily hydrolysed by water, acids, bases or enzymes and yield gallotannins and ellagitannins.

Condensed tannins

These are Flavonoids (Polymers of flavonol.) Both hydrolysable and condensed tannins are widely distributed in nature. Tannin content of certain feedstuffs are as follows:

- Tannins are astringent in nature.
- They cause a dry or puckery sensation in the mouth, probably by reducing the lubricant action of the glycoproteins in the saliva.
- They bind the proteins and are thus inhibitors of proteolytic enzymes.
- High tannin content also depresses cellulose activity and thus affects digestion of crude fibre.

- Tannins reduce the digestibility of dry matter, protein and other nutrients.
- Sorghum contains high levels of condensed tannins.
- Most of the tannins are located in the seed coat. Hence, decortications of seeds will reduce the tannin content.
- Germination of legume also results in a decrease in the tannin content.

Methods of Demagnification: The methods available for removal or inactivation of tannins can be divided into two main categories:

- Physical Treatment: Soaking and cooking decrease the tannin content. However, these treatment cause a substantial loss of DM between 20 to 70%.

Anaerobic storage of moist sorghum grains for two and nine days resulted in 40 and 92% reduction in tannins, respectively.

Chemical Treatments: Addition of tannin complexing agents like polyethylene glycol (PEG) and polyvinyl pyroldone (PVP) prevent formation of complexes between tannin and protein as well as break the already formed complex thus liberating protein. Alkalies, formaldehyde, organic solvents like acetone, acids H_2O_2 reduce the tannin content.

Precaution

More than 4% concentration of tannin has been reported to be toxic for ruminants as they are more resistant to microbial attack and are harmful to a variety of microorganisms. Toxic level of tannin can be reduced by physical methods like soaking, heat treatment and drying before feeding of forage. Several studies reported that feeding tannin-rich leaves with concentrate rations reduces the adverse effect. This is due to spairying effect of consume protein in excess of their requirement from the concentrate and therefore, the anti-nutritional effects of tannins were masked.

Group – IV

Antimetals: Substances depressing the utilization of minerals.

Phytic acid

- Is an ester formed by combination of the 6 alcoholic groups of inositol with 6 molecules of hexa phosphoric acid. Hence, its name Inosital hexaphosphoric acid.
- Seeds of cereals, dried legumes, oilseeds and nuts are rich in phytic acid.
- Phytic acid concentration is more in the rind (Pericap + aleurone layer) and the embryo than the core (endosperm).
- Phytic acid depresses the utilization of several minerals elements such as Ca, Mg, Fe, Zn etc. by forming insoluble compounds which are eliminated in the faces.

Oxalic acid

- Plant foodstuffs have much oxalic acid while those of animal origin have relatively little oxalic acid.
- The leaves are rich in oxalates compared to other parts.
- Young leaves contain less amounts than mature leaves.
- Ageing as well as over ripening of vegetables is accompanied by an increase in the proportion of calcium oxalate.
- Pigs and poultry are affected.
- Animal response to oxalate poisoning varies with species of animal and species of plant
- Oxalate poisoning in cattle and sheep are characterized by rapid and labored respiration, depression, weakness, coma and death.

Oxalate is an anti-nutritional content, when it is digested; it comes into contact with the nutrients in the gastrointestinal tract. After released, oxalic acid binds with nutrients, rendering them inaccessible to the body. More quantity of oxalic acid is consumed regularly, nutritional deficiencies are likely to occur, as well as severe irritation to the gastrointestinal tract mucosal lining. Strong chemical and chelated bonds are formed between oxalic acid, and various other minerals, such as Calcium, Magnesium, Sodium, and Potassium. This chemical combination results in the formation of oxalate salts. Oxalates react with Calcium to produce insoluble Calcium Oxalate complex reducing calcium absorption in the gut. This leads to a disturbance in the absorbed Calcium: Phosphorus ratio, resulting in mobilization of bone mineral to alleviate the hypocalcaemia and calcium drain out from the body and excreted through urine and faeces. Continuous mobilization of bone minerals results in nutritional secondary hyperparathyroidism or osteodystrophy fibrosa. Young plants contain more oxalate than older plants. During early stages of growth, there is a rapid rise in

oxalate content followed by a decline in oxalate levels as the plant matures [11]. Several researchers reported that oxalate content is highest in leaf tissue, followed by stem tissue [12].

Precaution

Rumen micro-organisms degrade dietary into formic acid and CO_2. Adaptability reduces the toxicity of oxalate in the body. Ruminants adapted to diets with high oxalate content can tolerate oxalate levels that are lethal to non-adapted animals. Moreover, it has been shown that the transfer of rumen fluid from animals in Hawaii to Australian ruminants resulted in complete elimination of the toxic effects of mimosine and the bacteria involved in such effects have been identified.

Anti–vitamins

These are organic compounds, which either destroy certain vitamins or combine and from unabsorbable complexes or interfere with digestive and/or metabolic functions.

- **Anti–vitamin A**: Raw Soyabeen contains enzymes lipoxygenase, which can be destroyed by heating 5 minute steam at atmospheric pressure. Lipoxygenase catalyses oxidation of carotene, the precursor of vitamin A.
- **Anti-vitamin D:** Rachitogenic activity of isolated soya protein (unheated) has been found with chicks and pigs. Autoclaving eliminates this activity.
- **Anti-vitamin E:** Present in Kidney bean. Diets with raw kidney beans produced muscular dystrophy in chicks and lambs by reducing plasma vitamin E. Autoclaving destroys this factor.
- **Anti-vitamin K:** Eating Sweet clover cause fatal haemorrhagic condition in cattle known as Sweet clover disease**.** Dicoumarol present in sweet clover is responsible for this. Dicoumarol reduce prothrombin levels in blood and affects blood clotting.
- **Anti–Pyridoxine:** An antagonist of pyridoxine from linseed has been identified as 1 – amino –D-proline. It occurs naturally in combination with glutamic acid as a peptide and it is called linatine. Nutritive value of linseed meal for chicks can be considerably improved after water treatment and autoclaving.
- **Anti-Niacin:** An antagonist of Niacin, niacytin is found in Maize, Wheat bran etc. that causes Perosis and growth depression.

Other toxic factors

Nitrate

Nitrate is the form of nitrogen in the atmosphere take up by plant roots from the soil, and is transported to the leaves. In stress condition excess nitrates accumulated in the plants. Drought or hot dry winds causes water stress leads to nitrate accumulation. Damage caused by hail or frost impairs photosynthesis resulting in excess nitrates accumulation and causes toxicity in livestock.

Cool cloudy weather can also cause the nitrates accumulation problem. During initial growth, much of the nitrate taken up by the plant is used for root and shoot development. At this stage, the roots are able to take up more nitrate than is required and it accumulates in the stems and leaves of the plant. As the plant develops, the leaves of the plant are able to convert more nitrate into plant protein, therefore less "surplus" nitrate is found in the plant as it matures. Fodder crops such as Sudan grass, pearl millet and oats can accumulate Nitrate at potentially toxic levels. Most of the nitrate accumulates in stem, followed by leaves and very little in the grains [13]. In ruminant nitrate is normally converted to nitrate - nitrite - ammonia - amino acid to protein in the rumen in presence of microorganisms. When forages have an unusually high concentration of nitrate, the animal cannot complete the conversion and nitrite accumulates. Through the rumen wall, Nitrite is absorbed and transported to the blood stream directly and converts haemoglobin (the O_2 carrying molecule) in the blood to met haemoglobin, which cannot carry oxygen. The blood turns to a coffee colour rather than the usual bright red. An animal dying from nitrate (nitrite) poisoning actually dies from lack of oxygen (asphyxiation). The rate and quantity of fodder consumption, type of forage, energy level or adequacy of the diet are the factors affecting the severity of nitrate poisoning.

S.No.	Nitrate Content (ppm)	Effect on Animals
1	0-1000	This level is considered safe to feed under all conditions.
2	1000-1500	This level should be safe to feed to non-pregnant animals under all conditions. It may be best to limit its use to pregnant animals to 50% of the total ration on a dry basis.
3	1500-2000	Feeds are fed safely if limited to 50 per cent of ration"s total dry matter.
4	2000-3500	Feeds should be limited to 35-40 per cent of total dry matter in the ration. Feeds containing over 2000 ppm nitrate nitrogen should not be used for pregnant animals
5	3500-4000	Feeds should be limited to 25 per cent of total dry matter in ration. Do not use for pregnant animals.
6	>4000	Feeds containing over 4000 ppm are potentially toxic. Do not feed

Table 3: Level of Nitrate in forage (DM Basis) and potential effects on animals [14].

Precaution

Annual forages are more susceptible than perennial forage for Nitrates accumulation and toxicity. Adverse climate eg. period of drought or wet, dull weather condition are more prone to Nitrate toxicity. Following steps can reduce the risk of nitrate toxicity:

Dilute the nitrate content of the total ration by feeding a combination of low and high nitrate feeds. Animal should be fed the ration, three or four times daily rather than just one meal per day. Allow cattle to sensitize with nitrate slowly to increase the nitrate content of the ration. Ensure balanced ration feeding to livestock for the level of production that is expected. Balance concentrate diet should be given along with feed contain nitrate to cattle to reduce toxicity.

B. β-N-oxalyl-L-α, β-diaminopropionic acid (β-ODAP or BOAA)

Potent neuro-toxic activity is due to excess feeding of Lathyrus containing β-N-oxalyl-L-α, β-diaminopropionic acid, a naturally occurring amino acid, possesses and has been shown to be responsible for outbreaks of neurolathyrism. β-ODAP occurs naturally as two isomeric forms with the α-form being approximately 5% of the total and β-isomer is major concern of toxicity. Genetic factors and environmental conditions effects the level of β-ODAP in dry seed. Zinc-deficieny or rich in ferrous iron in *Lathirus sativus* grown in nutrient solutions have elevated levels of β-ODAP. β-ODAP is biosynthesized during the ripening of the seed and is further increased during germination. The ingestion of ODAP causes neuro-lathyrism, a neuro-degenerative disease that damages upper motor neurons, causing irreversible paralysis of the lower limbs and sometimes death in humans and animals [15]. In Ethiopia, other studies reported ODAP content in seeds varying from 5.4 to 8.9 g/kg DM or 2.0 to 4.5 g/kg DM [16]. The green parts and the straw contain lower concentrations of ODAP: 1.9 to 3.4 and 1.3 to 2.1 g/kg DM respectively [17].

Precaution

Soft and tender part of plant and leaves in excess quantity should be avoided for feeding animals. Toxicity can be reduced by water soaking or hot water soaking for few hours. Concentrates along with dry wheat or paddy straw should be feed along with Lathyrus to the big animals to reduce toxicity.

Mimosine

Mimosine, a non-protein amino acid structurally similarity with tyrosine, present in genus *Leucaena leucocephala* in which the level of mimosine in the leaf is about 2-6% and varies depending on season and maturity of leaf and stem. In non-ruminants mimosine toxicity cause alopecia, eye cataracts, poor growth and reproductive problems. More than 5-10% of Leucaena meal of the diet for poultry, rabbit and swine generally result in poor growth, reproduction and performance.

The main clinical symptoms of toxicity in ruminants includes poor body growth, alopesia, dullness, poor wool development, swollen and raw coronets above the hooves, lameness, mouth and oesophageal lesions, depressed serum thyroxine level and goiter. Symptoms may be due to metabolite of mimosine in the rumen and other‟s to 3,4 dihydroxypyridine. Decrease in calving percentage due to Leucaena feeding has also been noted by Jones RM., *et al* [16].

Precaution

Mimosine problem could be solved by genetic selection of strain of Leucena species containing low mimosine contents. But it is found that, low mimosine types of fodder are found to be unproductive and low vigour. This problem can be solved by feeding leucaena mixed with other feed fodder and concentrates. Hiremat, N.B. [18], suggested that use of Leucaena fodder may be restricted to 30% of green forage in the case of cattle and buffalo, and 50% for goats show better results in terms of production and growth. Physical treatment like heat treatment and chemical treatment and supplementation with amino acids or with metal ions such as, and Fe, Al and Zn reduces the mimosine toxicity.

Methods of reduce the deleterious effect of ANF's

A number of methods have been tried to overcome the deleterious effect of different anti-nutritional factor includes through making hay, silage with inoculants, using PEG; Urea or biological treatment with fungi can be applied to either take off or minimized and decrease anti-nutritional factors concentration.

It is well know that alkali treatment includes polyethylene glycol (PEG), which a tannins-binding agent, was shown to be a powerful tool for isolating the effect of tannins on various digestive function. Economical point of view it is not recommended. Although the adding of polyethylene glycol (PEG), which binds with and inactivates tannins and other ANF is quite effective, success of its adoption depends on the cost: benefit ratio. Russsell and Lolle [19] suggest feed animals with 1% urea which not only provides extra N but also deactivates the leaf tannins [20-25].

Conclusion

Numerous toxic factors in forages can cause toxicity in livestock are produced by the grasses, legumes, non-legumes and other herbs and shrubs. In India where there is acute shortage of feed and fodder whereas, forage and unconventional feed stuffs have tremendous potential for increasing the utilization of dietary nutrients, reducing environmental contamination and decrease feeding cost in low milking Indian cows. Areas specific feed and fodder selection and identification of anti-nutritional as well as nutritional factor to optimize all feed resources in order to reach its goal. Various aspects of toxic principals, their effect and its remedial measure is necessary for optimal feed management and utilization of feed and forage for better animal health and production.

Bibliography

1. Hegde NG. "Positive Attitude for Good Health and Happiness". Nature Cure Ashram, Urulikanchan, Pune (2006).
2. Wadhwan VM. "Toxicants in Feed stuffs: Impact on health. Recent Advances in Animal Nutrition Edited by M.P.S. Bakshi and M.Wadhwa. SSPH, New Delhi. (2014): 231-241.
3. Smitha PA. "The anti-nutritional factors in forages. A review". *Current Biotica* 6 (2013): 516-526.
4. Umaru HA., *et al*. "Levels of antinutritional factor in some wild edible fruits of nortrhern Nigeria". *African Journal of Biotechnology* 6 (2007): 1935-1938.
5. Sharma DD., *et al*. "The nutritive value and toxicity of OHI (Albizzic stipulate Bovin) tree leaves". *Journal of research Ludhiana* 6 (1969): 388-393.
6. Cheeke PR and Shull LR. "Natural toxicants in feeds and livestock". AVI Publishing Inc., West Port, Connecticut (1985).
7. Joshi DC., *et al.* "Studies on Mahua (Bassia latifolia) seed cake saponin (Mowrin) in cattle". *Indian Journal of Animal Nutrition* 6 (1989): 13-17.
8. Lemus R., et al. "Nutrient uptake of 'Alamo' switchgrass used as an energy crop". *Bio Energy Research* 2 (2009): 37-50.
9. Sarah R. "Prussic acid poisoning in Livestock" (2007).
10. Bahrani MJ and Deghani Ghenateghestani A. "Summer forage sorghum yield, protein and prussic acid contents as affected by plant density and nitrogen topdressing". *Journal of Agricultural Science and Technology* 6 (2004): 73-83.

11. Davis AM. "The oxalate, tannin, c rude fiber, and crude protein composition of young plants of some Atriplex species". *Journal of Range Management* 34 (1981): 329-331.

12. Jones RJ and Ford CW. "Some factors affecting the oxalate content of the tropical grass (Setaria sphacelata)". *Australian Journal of Experimental Agriculture and Animal Husbandry* 12 (1972): 400-406.

13. Singh Ajaib., *et al*. "Effect of application method of level of nitrogen fertilizer on nitrate content in oat fodder". *Indian Journal of Animal Nutrition* 17 (2000): 315-319.

14. John Andrae. "Preventing prussic acid poisoning". Forage Leaflet 13, Clemson University (2008).

15. Denekew Y and Tsega W. "Evaluation of b-ODAP content in forage, grain and straw of Lathyrus sativus in North West Ethiopia". *Livestock Research for Rural Development* 52 (2009): 161-166.

16. Jones RM., *et al*. "The effect of Leucaena leucocephla on the beef cattle reproduction of beef cattle grazing leucaena/grass pastures". *Tropical grasslans* 23 (1989): 108-114.

17. Spencer PS and Schaumburg HH. "Lathyrism: a neurotoxic disease". *Neurobehavioral Toxicology and Teratology* 5 (1983): 625-629.

18. Hiremat NB. "Subabul (Leucaena leucocephala)- a wonder plant". *Indian Dairyman* 33 (1981): 351-356.

19. Russel RW and Lolley J. "Deactivation of tannins in high tannin milo by treatment with urea". *Journal of Dairy Science* 72 (1989): 2427-2430.

20. Mc Donald., *et al*. Animal Nutrition Pearson Publication. London (2012).

21. Naidu MM and Reddy YR. "Anti-nutritional factors presents in feedstuffs and ameliorative measures". Feed Processing Technology. AICC, ANGRAU, Hyderabad. (2003): 185-195.

22. Rai SN. "Tannin contents in different agro-products and its bio-degradation in different species of ruminants". Compendium on Feed Processing Technology. AICC, ANGRAU, Hyderabad (2003): 196-201.

23. Reddy GVN., et al. "Technologies for enhancing feed quality". Team of Excellence on Feed Technology AICC, ANGRAU, Hyderabad (2005).

24. Reddy DV. "Principles of Animal Nutrition and Feed Technology". Oxford and IBH Publishing Co.Pvt. Ltd.New Delhi. (2012): 326-336

25. Verma DN. A Text book of Animal Nutrition Kalyani Publishers, New Delhi (2003).

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