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Management of clinical case of subabul (*Leucaena leucocephala*) poisoning in a goat kid

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Abstract

A two month old non descriptive male goat kid was presented to the Teaching Veterinary Clinical Complex (TVCC), Post Graduate Institute of Veterinary and Animal Sciences (PGIVAS), Akola in the month of July 2020 with the complaint of inappetence, complete loss of hairs from all over the body and dryness and scaling of the skin. History and clinical examination revealed feeding with the subabul (*Leucaena leucocephala*) since a month, heat seeking behavior, lethargy and shivering. The skin scrapping and fecal examination were negative. The case was diagnosed as a subabul (mimosine) poisoning on the basis of history, signs and clinical examination. The subabul was withdrawn from the feed and kid was treated with iron containing liver tonic and mineral mixture containing iron, copper and zinc. Kid showed clinical improvement from second week and recovered completely within month.

Keywords: *Leucaena leucocephala*, mimosine, subabul, kid, mineral mixture

Introduction

Goats are very versatile animals and provide source of income to poor farmers in rural areas and play an important role in socio-economic status of the farmers. Subabul (*Leucaena leucocephala*) is a tropical legume that is now widely distributed in India. In both sheep and goat, palatability of *Leucaena leucocephala* and *Ingadulce* were ranked first and second respectively [2].

Subabul is considered as a multipurpose tree for its ever-green protein rich foliage (20-30% CP), fuel wood, fast growing habit, pest resistance and durability under grazing, cutting and drought tolerance [3]. It is very critical to improve nutrition and ultimately to increase small stock productivity. *Leucaena* is a very important protein source for ruminants in all parts of South-East Asia. In spite of many beneficial nutritional properties, it contains the toxic non-protein free amino acid. *Leucaena* leaves are rich source of crude protein [6, 7] but presence of toxic amino acid β -(3-hydroxy-4-oxopyridyl) α -amino-propionic acid i.e. mimosine limits their utilization. Subabul toxicity is characterized by alopecia, anorexia, reduced weight gain and weight loss, excessive salivation, oesophageal lesions, enlarged thyroid and low circulating concentrations of thyroid hormones. Hammond found that mimosine and its degraded metabolic products [2, 3] DHP and 3-hydroxy-4-(1H) pyridone (3,4-DHP) are responsible for the goitrogenic and alopecic effect in ruminants [9]. Its poisoning is spontaneous in cattle, sheep and rabbit; however in goats it is rare. Many studies reported natural occurrence of *Leucaena leucocephala* toxicity in goat and its management under field condition [10]. Mimosine is also an iron chelator and affects metabolism of folate in mammalian cells [11]. Enzymes involved in blood clotting and fibrinolysis are inhibited by the serine protease inhibitor isolated from the seeds of *leucaena* [12]. Chronic or acute toxicosis can occur and removal of *L. leucocephala* from the diet is the effective way to treat the animals and hasten the recovery [13, 14, 15]. Foetal abortions [16], low bull fertility [17] and death [18, 19] were recorded by *leucaena* feeding. Effects of *leucaena* feeding on reproductive performance especially on the semen quality of goats found reduced concentration of spermatozoa [20]. The present case paper reports a successful therapeutic management of *Leucaena leucocephala* poisoning in a goat kid.

History, Clinical examination and Diagnosis

A two months old non descriptive male goat kid from village Shivani, district Akola, was presented to the Teaching Veterinary Clinical Complex (TVCC), Post Graduate Institute of Veterinary and Animal Sciences (PGIVAS), Akola with the complaint of inappetence, complete loss of hairs from all over the body and dryness and scaling of the skin.

History and clinical examination revealed continuous feeding of leaves of subabul (*Leucaena leucocephala*) tree since month, normal rectal temperature (100 OF), bradycardia on auscultation, pale mucous membranes, inappetence, weakness, lethargy and alopecia all over the body. The laboratory examination revealed low Hb (8.3gm/dl), PCV (28%), TEC (5.2/cumm) and negative skin scrapping and fecal sample examinations. The case was diagnosed as a mimosine poisoning on the basis of history, clinical examination and laboratory findings.



Fig 1: Alopecia all over the back (Before Treatment)

Treatment and Result

In the present case, the kid was being fed on leaves of subabul (*Leucaena leucocephala*) tree since month which might be resulted into mimosine poisoning. As the kid was anaemic hence advised iron containing liver tonic @ 3 ml PO BID for one month and mineral mixture containing Vitamin A, D, E, and iron, Copper and Zinc @ 5 gm PO OID for one month along with bolus Boost up ¼th PO OID to promote establishment of ruminal microflora. The owner advised complete withdrawal of subabul tree leaves from the feed. Kid showed improvement in clinical signs from second week onwards and recovered completely in one month.



Fig 2: Hairs started to regrow (After two weeks)



Fig 3: Hairs fully grown (After one month)

Discussion and Conclusion

The Subabul (*Leucaena leucocephala*) is a highly palatable and nutritious ruminant feed. In spite of presence of mimosine in the leaves livestock are reared on it. Mimosine is the main toxic principle of Subabul it is non-protein free amino acid and metabolise to 3- hydroxyl – 4 (1H) – pyridone (3, 4 dihydroxy pyridine; 3,4 DHP) having potent goitrogenic properties. In Some ruminants it is degraded to 3, 4- or 2, 3-dihydroxypyridine (DHP) to nontoxic compounds by host specific ruminal bacteria ^[21]. Ruminants (cattle, sheep, and goats) tolerate mimosine due to presence of ruminal microflora whereas non-ruminants (horses, pigs and poultry) do not ^[22]. However toxicity in ruminants depends on the amount and duration of subabul in the diet ^[23].

In the present case kid developed the clinical signs one month after feeding the subabul leaves indicating chronic toxicity. Continuous feeding of subabul leaves for the period of one month manifested clinically as alopecia in this kid ^[24]. Shivering and lethargy in the present case may be due subclinical deficiency of thyroid hormone and minerals. In this case kid had diffuse alopecia which indicating toxic effect of mimosine. It interferes with the cysteine synthesis from methionine by virtue of its depilatory action and reduces synthesis of hair proteins affecting hair growth ^[25]. Mimosine is structurally similar to tyrosine that suppresses tyrosinase and tyrosine decarboxylase. Being anti-peroxidase it inhibits peroxidase and lactoperoxidase reactions, by interrupting the iodination of tyrosine, thus affects the synthesis of T1, T2, T3 and T4 leading to enlargement of neck region due to enlargement of thyroid gland on gross examination²¹ which was not observed in the present case.

Urine analysis of affected animal by HPLC is the most accurate method of estimating toxicity of mimosine metabolites ^[19]. Cost involved in HPLC analysis is quite high and unaffordable to poor farmers in developing countries like India. Therefore the present case of *Leucaena leucocephala* poisoning was diagnosed based on the case history, clinical signs and laboratory and skin scrapping examination and confirmation done on the basis of remarkable response to the given treatment. The case was treated with mineral mixture (Chelated Agrimine forte, Virbac Animal Health) consisting of Vitamin A, D3, E, iron, iodine, cobalt, manganese, copper, zinc and Sulphur and Liver tonic (Livofeol, Vetcare Animal Health) orally twice in a day for a period of two weeks. The owner was advised to withdraw subabul tree leaves from the feed. The animal responded very well to the given treatment and started showing recovery two week after the initiation of the treatment. In this case mineral mixture supplementation alleviated mimosine toxicity by preventing its absorption and promoting its excretion via feces in the form of complexes formed by binding Ferrous, Copper and Zinc with Mimosine and DHP.

Because of high protein content and drought resistance, *Leucaena leucocephala* can be used as an excellent fodder tree especially during summer season but limits their use due to toxic principles mimosine and DHP. Hence proper measures should be followed to minimize the toxic effects of mimosine and retain the protein levels to the optimum. Toxicity of subabul can be prevented by feeding subabul in the proportion of less than 40 % in the diet, adding iodinated salt to subabul during feeding, mineral supplementation and soaking the subabul in water and drying off before feeding ^[10].

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