Experimental *Tribulus terrestris* Poisoning in Sheep: Clinical, Laboratory and Pathological Findings

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ABSTRACT

Eleven native sheep, 1–2 years old, of both sexes were randomly divided into two groups, 6 sheep being allocated to the experimental group and 5 serving as controls. The sheep in the experimental group were fed 80% *Tribulus terrestris* and 20% alfalfa hay and wheat straw, while the control sheep were given a mixture of 40% alfalfa hay and 60% wheat straw. Clinical signs of hepatogenous photosensitivity were observed from day 11, including reddening and crust formation on the muzzle, nose, ears and eyelids, depression, weight loss, icterus, conjunctivitis, and yellow discoloration of the urine. Laboratory findings on weekly samples indicated significant differences (*p*<0.05) in white blood cell count, total plasma protein and fibrinogen, total and direct bilirubin, blood urea nitrogen and creatinine concentrations, and aspartate aminotransferase and alkaline phosphatase activities. There were no significant differences in the packed cell volume, in the neutrophil, lymphocyte or eosinophil counts, or in the serum calcium, phosphorus, potassium, sodium or chloride concentrations. At necropsy of the experimental animals, there were various degrees of generalized icterus and the livers were swollen and discolored by bile pigment. Histopathological examination revealed varying amounts of crystallloid material in the bile ducts and renal tubules, hepatocellular degeneration, biliary fibrosis and proliferation, renal tubular necrosis and focal necrosis of cardiac muscle.

Keywords: alkaline phosphatase, aspartate aminotransferase, bilirubin, caltrop, clinical signs, diagnosis, jaundice, photosensitivity, plasma protein, sheep

Abbreviations: ALP, alkaline phosphatase; AST, aspartate aminotransferase; BUN, blood urea nitrogen; PCV, packed cell volume; WBC, white blood cells

INTRODUCTION

*Tribulus terrestris* (caltrop, puncture vine) is a prostrate annual herb belonging to the plant family of Zygophyllaceae and has a worldwide distribution. Under certain conditions, ingestion of this herb induces a hepatogenous photosensitization in sheep and goats, known as geeldikkop, tubulobis ovis or yellow big head (Henning, 1932; Van Tonder et al., 1972; Glastonbury et al., 1984). In Australia, a locomotor disorder of sheep has been reported to be associated with feeding of *T. terrestris* (Bourke, 1984; Bourk et al., 1992).
Tribulosis ovis has great economic importance in South Africa, as more than 0.5 million animals may be affected in a single season (Kellerman et al., 1996) and it has been intensively investigated in that country (Kellerman et al., 1980). It has also been reported from Australia (Bourke, 1983; Glastonbury et al., 1984; Jacob and Peet, 1987), the United States (McDonough et al., 1994), Argentina (Tapia et al., 1994) and Iran (Amjadi et al., 1977).

The disease is one of the photosensitization diseases of small ruminants, characterized by the deposition of optically active, birefringent, crystalloid material in the biliary system (Miles et al., 1994a). The occlusion of the bile ducts by crystalloid material results in failure of the liver to excrete phylloerythrin (a photodynamic porphyrin) in the bile, resulting in its accumulation in the blood (Kellerman et al., 1996). It has been suggested that the crystallloid-inducing factors in *T. terrestris* are the steroidal saponins diosgenin and yamogenin, which are converted to epismilagenin and episarsasapogenin following ingestion of the plant by ruminants (Miles et al., 1994a,b). It has also been shown that there is a variation in the chemotypes of saponins from *T. terrestris* collected from different regions (Wilkins et al., 1996).

The plant also contains a mixture of the β-carboline alkaloids: harmane, norharmane, tetrahydroharmane, harmine, harmaline, harmol, harmalol, ruind and dihydruin (Bourke et al., 1990). It has been suggested that it is these alkaloids that cause a locomotor disorder in sheep associated with prolonged ingestion of large quantities of the plant (Bourke, 1987; Bourke et al., 1992).

Although *T. terrestris* grows in most regions of Iran, particularly in the central and north-east provinces, there is only one report of photosensitization in sheep associated with its ingestion (Amjadi et al., 1977). The plant is widely distributed in Khorasan and there have recently been a number of undocumented reports of photodermatitis thought to be due to grazing on the plant and observed by farmers and/or local veterinarians. The object of this study was to evaluate the ability of *T. terrestris* growing in Khorasan province to cause photosensitization in sheep and to describe the clinical, laboratory and pathological findings of the resulting disease.

**MATERIALS AND METHODS**

**Animals**

Eleven, 1–2 year old, native and apparently healthy sheep of both sexes were dewormed 14 days before commencement of the experiment by subcutaneous injection of ivermectin (Ivomec, Razak Co., Tehran, Iran) and oral administration of raloxanide (Ranide, Damloran Co., Tehran, Iran) at dose rates of 0.22 and 7.5 mg/kg body weight, respectively. The animals were sheared and randomly divided into two groups, 6 sheep being allocated to the experimental group and 5 sheep serving as controls. The animals were placed in two adjoining pens without protection against the prevailing climatic conditions.