

The Issue of Intoxication in sheep from the consumption of plants with photodynamic content

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Abstract— Our aim in this paper was to study the cases of sheep intoxication in South of Albania, from the consumption of plants containing photodynamic substances. The study was achieved by collaboration of veterinarians and farmers of this area, using a questionnaire and database for a detailed anamnesis, clinical signs, different plants consumption, contact with sunlight, as well as making a differential diagnosis. In these areas, several pasture plants are known to creating photosensitization in grazing livestock such as: *Trifolium pratense*, *Medicago sativa*, *Hypericum perforatum*, *Poligonium aviculare*, *Lupinus albus*. Those pasture plants contain photodynamic substances such as phylloerythrin, rutin, quercitrin, phagopyrin, photophagopyrin, fluoricine, hypericin etc. The high consumption of these plants and exposure for a long time to the sun's rays can cause us poisoning with reactions expressed by anorexia, photophobia, conjunctivitis, redness in places not covered with fur, itching, edema, even dermatitis with injuries. Our results showed that 78 sheep or 0.95% of the 8200 monitored animals were poisoned by consuming plants containing photodynamic substances, and 11 sheep or 0.13% ended in death. The highest percentage of intoxications was in the months of June and July, respectively 34.43% and 28.68% of the total intoxications. The prognosis was generally favorable. The treatment started with placing the sick animals in the shade, then general symptomatic treatments were given. We used purgatives to empty the digestive system in some animals, antihistamines, cortisones and wound treatment as appropriate. We recommend to farmers to prevent these problems, grazing should be organized in the sunless time or early in the morning or late in the evening.

Keywords—Photosensitization, photodynamic substances, phylloerythrin, dermatitis, sheep.

I. INTRODUCTION

In many spontaneous plant species in various regions of Albania, as well as in many other countries worldwide, substances are contained that, when entering the animal organism, cause increased sensitivity of specific tissues to sunlight, known as

photosensitization reactions [10];[6];[19]. These reactions are caused by so-called "photodynamic" substances and occur in animals both through excessive consumption and liver dysfunction. They occur more often in the parts of the body that are more exposed to the sun, are not covered with hair, and are unpigmented [18];[13].

Photodynamic substances are found in plants but can also form in the body under the action of bacterial flora, such as phylloerythrin formed from chlorophyll. Photodynamic substances are generally fluorescent pigments with the ability to react with sunlight. They are normally absorbed by the digestive system, detoxified in the liver, and excreted through the biliary route (feces). When these substances are taken in excess or when the liver functions are impaired (various diseases), they enter the peripheral blood circulation, causing inflammatory reactions [20].

Photosensitisation is a cutaneous disorder caused by a substance that makes the skin sensitive to solar radiation. When this substance is endogenous (phylloerythrin) as a result of chlorophyll not being metabolized in the liver, by hepatic failure, photosensitization is called secondary [18];[9];[14]. When the substance is of exogenous origin, photosensitization is primary [11]. According to Collet, 2019, there are four groups in the classification system for photosensitization diseases, known as primary (or direct), secondary (indirect or hepatogenous), endogenous (aberrant porphyrin synthesis), and idiopathic [7];[15];[17].

In our country, some plants containing photosensitizing substances are recognized, such; as *Trifolium pratense*, *Medicago sativa*, *Hypericum perforatum*, *Poligonium aviculare*, *Lupinus albus*, which contain high amounts of photodynamic substances such as phylloerythrin, rutin, quercitrin, phagopyrin, photophagopyrin, hypericin, fluoricin [18];[12].

These plants cause poisoning not only when they are green but also when they are dry, as well as their seeds. The sensitivity of different animals to photodynamic substances follows this descending order: pigs, sheep, goats, horses, and cattle.

Plants like *Hypericum perforatum* cause photosensitisation in the first group, or direct [3];[16];[4]. Hypericin photosensitization in domestic livestock manifests with classic clinical signs of UV photosensitivity, including reddening and edema of tissues of the muzzle, eyes, and ears, along with increased rectal temperature [3]. Hypericin is a

phenanthroperylenequinone that can form strong associations with a variety of proteins; its mode of action during photosensitization and potential as a photodynamic therapeutic have been well studied [1];[22]. Photoactivated hypericin [5], is a potent generator of singlet oxygen (1O_2), superoxide anions, and other reactive oxygen species such as hydrogen peroxide (H_2O_2) [8].

Clinical signs in poisonings with photodynamic substances usually appear unexpectedly when animals are exposed to sunlight and are expressed with anorexia, photophobia, conjunctivitis, restlessness, and attempts to move away from the sun into the shade [18];[12].

If exposure to the sun continues in uncovered (hairless/furry) and unpigmented areas, erythema, edema, and pain on touch are observed, leading to the formation of vesicles, pustules, and wounds. Such areas of the body include the vulva, scrotum, perineum, udders, head, ears, etc. [18].

As a result of the accumulation of transudate in the skin layers, irritation of its nerve endings occurs, causing itching by the animal, with rubbing, biting, licking, or rubbing against objects, leading to the disruption of the integrity of the affected tissues, forming wounds. Further worsening of the inflammatory process results in necrotic areas of the skin accompanied by hair loss and partial loss of the skin, forming ulcerative lesions. When the processes are localized in the udder, animals refuse milking.

In addition to local signs and appearances, general effects such as jaundice, stomatitis, increased breathing, and nervous signs may be observed, expressed with anxiety, a fearful state, irregular movements, convulsive attacks, etc. In special cases, rhinitis and laryngitis, as well as conjunctivitis progressing to purulent panophthalmia, may be noticed. In horse photosensitization, it is more evident in white and light-colored breeds.

Mortality in these poisonings depends on the type of plant, the amount consumed, and the duration of exposure.

In photosensitising plant poisonings, anatomopathological changes are quite characteristic in the external parts of the body, in the aforementioned regions; however, they depend on the type of plant and the duration of poisoning. Other changes such as icterus of mucous membranes and carcasses, enlargement of the liver, and degeneration of the kidneys are also not lacking.

In general, establishing a diagnosis in these poisonings is not difficult, but it requires careful consideration of the clinical manifestations. In pigs, it should be differentiated from allergic urticaria, parasitic pruritus, Aujesky's disease, etc.

In general, the prognosis is favorable. Treatment begins by placing the affected animals in the shade, followed by general symptomatic treatments. Purgatives are used for digestive system clearance, antihistamines, corticosteroids, as well as wound treatment as needed.

Prevention of problems with photosensitising plants is achieved by gradually organizing grazing in weather

without sunlight or early in the morning, late in the evening, etc.

The issues with photosensitising plants are known to veterinary doctors, but they are neglected in everyday practice, as the mortality from these plants is low. Many animals that may have symptoms of dermatitis from photosensitising plants pass without being assessed.

To draw a clearer conclusion about the economic damage that can be caused by photosensitizing plants consumed by animals, we attempted to monitor based on collaboration with veterinarians in the Tepelena and Gjirokaster regions.

II. MATERIAL AND METHODS

The study was conducted using the methodology of direct collaboration between veterinarians and farmers in this area, using a questionnaire and a database for detailed anamnesis, clinical signs, consumed plants, sunlight exposure, and conducting a differential diagnosis to conclude the final diagnosis.

Data were collected from 138 herds of sheep with a total of 8200 sheep, starting from the Tepelena to Gjirokaster. The herds to be monitored were identified, contacts with the respective veterinarians and farmers were established, and a questionnaire was compiled, highlighting the problems arising from the consumption of photosensitising plants. All forms of dermatitis in sheep were noted, attempting to make a differential diagnosis with other diseases that may have similar clinical signs, such as parasitic, microbial diseases, etc.

Data processing and analysis were carried out, taking into account contemporary literature on poisonings of this nature.

III. RESULTS AND THEIR INTERPRETATION

The following tables presents the results of our monitoring. Out of 138 herds of cows monitored, a total of 8200 cows, clear clinical signs of dermatitis caused by the consumption of photosensitive plants were observed in 78 herds, or 0.95% of the total number of herds.

TABLE I. Morbidity in sheep from Photosensitisation Plants in the years 2021-2022.

Number of sheep in our study	Number of sheep intoxicated	% of morbidity
8200	78	0.95%

Intoxication of sheep by photosensitising plants is related to the grazing habits of the mentioned species. In the studied area, the herds we selected for monitoring graze in nature and belong to the extensive grazing system. Grazing in nature creates a higher probability of coming into contact with photosensitising plants, as well as with sunlight rays during days with an increased UV index. The farmers in the Tepelena and Gjirokaster regions are traditional and knowledgeable about plants that can cause issues in sheep. Most of these farmers know that the sheep are sensitive to sunlight rays, so they bring them out early

in the pastures and place them in shaded areas during the day.

TABLE II. Mortality in sheep from Photosensitisation Plants in the years 2021-2022

Nr. of sheep	Nr. of sheep intoxicated	Nr. of dead Sheep	% of mortality in total sheep	% of mortality in intoxicated sheep
8200	78	11	0.13%	14.10%

More problems have occurred in the herds of younger farmers, without the necessary experience, who leave the sheep in the pastures for longer periods and bring them back or move them later, exposing them more to sunlight rays.

From the above table, we can see that the mortality in sheep is low. The total mortality is only 0.13% of the total monitored sheep. However, the mortality of animals that show clinical signs in our case goes up to 14.10%. This is due to the lack of timely treatment of clinical signs. Excessive itching in animals that initiates the dermatitis process, if not assessed and treated, leads to severe wounds and skin infections that end in forced euthanasia or even necrosis, although cases of necrosis are rare.

TABLE III. Epidemiology of intoxications from photosensitisation plants in sheep, by months for the years 2021-2022.

Months	Number of sheep intoxicated	% to the total number of sheep
January	-	0
February	-	0
March	-	0
April	-	0
May	6	7.69%
June	26	33.33%
July	22	28.21%
August	14	17.95%
September	8	10.26%
October	2	2.56%
November	-	0
December	-	0
Total	78	100%

From the above table, we observe that the summer months have the highest statistics of animal intoxications from photosensitization plants. The month with the highest percentage of poisonings from photosensitization plants is June (33.33%), followed by July (28.21%). In the Tepelena and Gjirokaster regions, as well as in most of Albania, June is the month with the highest vegetation, but in recent years, it also has high sunlight radiation. It seems that in June, sheep intake higher amounts of photodynamic substances and come into contact with sunlight rays, which are at a significantly high index during this month, causing problems in animals with dermatitis and other clinical signs. In early July, vegetation

continues, along with an increase in sunlight radiation. In August, although sunlight radiation is high, the amount of photosensitizing plants is not as much as in June and July, so cases of photosensitisation decrease.

In our cases, treatment began by separating the sick animals and placing them in the shade, followed by general symptomatic treatments. In some cases, we used purgatives for digestive system clearance. In the early stages of itching, antihistamines and fewer corticosteroids were used. In cases of wounds when the process progressed slowly, wounds were treated with various ointments depending on the advancement of the wounds, starting with zinc oxide-containing ointments for wound regeneration and progressing to ointments containing antihistamines or even antibiotics in cases where the wounds became infected [18];[12].

CONCLUSIONS

From the theoretical information as well as from monitoring and data collected through questionnaires and contacts with veterinarians or farmers in Tepelena and Gjirokaster, we conclude that intoxications from photosensitisation plants are present (0.95%) in sheep herds. Although the morbidity rate is low, it should be taken into consideration for the economic damages it may cause in sheep.

Educating farmers to pay more attention to their animals during the period from early May to the end of September, avoiding excessive consumption of photosensitisation plants, and not allowing animals to stay for a long time under the action of sunlight rays is crucial.

It is important to improve the information of veterinarians as well as farmers regarding preventive and therapeutic measures in cases of problems in sheep due to the consumption of photosensitisation plants.

Based on the above experience, we recommend educating farmers, especially young farmers, on cases of intoxication with photosensitisation plants.

We recommend early grazing during the morning and returning to the stables before the high UV index of sunlight begins.

We recommend early treatment of animals, using antihistamines and symptomatic treatment according to the case.

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