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CASE REPORT
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Congenital Cataract in a Blackbelly Lamb

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ABSTRACT

***Background*:** A cataract is an opacity of the crystalline structure that results in impaired vision. The congenital form manifests itself at birth or shortly thereafter and might also be inherited and therefore capable of passing on to descendants. Cataracts can be caused by systemic diseases, medications, toxic substances, radiation, metabolic alterations, dietary deficiencies, inflammation, traumatic injuries, age, or genetic factors. The few Blackbelly sheep herds are located in the northeast and north regions of Brazil and are considered rare, which could result in high levels of consanguinity. In this context, we report a case of congenital cataract in a Blackbelly lamb and its possible etiology.

***Case*:** A 3-month-old lamb presented with ophthalmic alterations since birth, with white and cloudy spots in both eyes and impaired vision. In the same herd, 3 elderly sheep showed similar ophthalmic alterations. The lamb was able to follow its dam, but when walking, bumped into small objects or very close to his vision field. The lamb managed to follow the herd and dodge large objects, suggesting partial vision loss. During a physical examination, both lens showed opacity and reduced corneal reflex, pupillary reflex to direct light, pupillary reflex to consensual light, and threat reflex. Ultrasonographic examination revealed that both lens presented hyperechogenicity. Hematological values were within the reference limits. In the same herd, three elderly sheep presented bilateral cataracts (2 rams and 1 ewe) in previous years, which at that time was attributed to natural aging. One ram was the lamb's grandfather. The other ram was the father of the female, both with cataracts. Based on history, physical examination, and complementary examinations, the lamb was diagnosed with bilateral congenital cataracts with a probable hereditary condition.

***Discussion*:** Multiple factors can be related to the etiology of cataracts, and it can be difficult to establish the correct etiology. Regarding the age of onset, cataracts can be classified mainly as congenital and senile. Senile cataract is a bilateral opacification process that involves the entire lens, with slow progression and gradual loss of vision with increasing age. In adult sheep, the high proportion of eyes affected by spontaneously arising cataracts could be related to age, increased exposure to sunlight, increased genetic susceptibility, or a combination of these factors. In this case, the herd had three adult elderly sheep with cataracts previously characterized as senile. However, after reviewing the genealogy, it was found that all animals had some degree of parentage, suggesting a hereditary factor. Congenital cataracts are expressed soon after birth, resulting from the malformation of fibers in the lens, and are generally nonprogressive. The congenital form may or may not be associated with hereditary factors. Inheritance cataracts have been reported in several breeds of dogs and usually occur as an autosomal recessive trait. Blackbelly sheep are rare in Brazil, favoring consanguinity, so we believe that cataracts are inherited in this herd. To control this ophthalmic alteration, all animals with crystalline opacities were excluded from reproduction, and the herd should be monitored in future cases.

Keywords: crystalline, eye, inherited, lens, ophthalmology.

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INTRODUCTION

Cataract is defined as any opacity in the lens that causes impaired vision [9]. The congenital form normally appears at birth or shortly thereafter. Cataracts can be caused by systemic diseases, medications or other toxic substances, radiation, metabolic alterations, dietary deficiencies, inflammation, traumatic injuries, age, and genetic factors [3,8].

Inherited cataracts in sheep were first described in the New Zealand Romney breed, and classified as inherited as a simple autosomal dominant trait [5]. With this inheritance pattern, an affected heterozygous sire mated with a normal unrelated female would be expected to produce equal numbers of affected and normal offspring. An affected heterozygous sire mated with his affected daughters would be expected to produce 3 affected and 1 normal offspring for every 4 lambs born. One in 4 lambs is expected to be homozygous for the defective gene and should therefore show a more severe manifestation of cataract [5].

The Blackbelly sheep is medium-sized, polled, without wool, colored with all shades of brown, tan, or yellow, contrasting with black underparts. This breed is considered rustic and adapted to tropical regions (high temperature and humidity), resistance to disease, tolerance to parasites, high reproductive efficiency, and prolificacy [10]. In Brazil, the few herds are located in the northeast and north regions of the country, especially in Roraima State.

Considering that this breed is rare in Brazil, high rates of consanguinity are expected, which favor the occurrence of genetic diseases. In this context, we report a case of congenital cataract in a Blackbelly lamb.

CASE

A 3-month-old Blackbelly lamb, weighing 15 kg, living in a Blackbelly Sheep Conservation Center" (Núcleo de Conservação de Ovinos Barriga Negra), which belong to the "Brazilian Agricultural Research Corporation" (Embrapa), in Boa Vista city, Roraima State, Brazil, was evaluated.

The complaint was that the lamb had difficulty following its dam since birth, bumped into obstacles, presented a white and cloudy spot on its eyes. Three elderly sheep also showed similar ophthalmic alterations in previous years on the same farm.

Lamb and dam were kept on pastures of *Urochloa humidicola*, *Cynodon* spp., and *Panicum maximum*, with access to mineral salt, soybean grains, and corn, with approximately 14% crude protein, supplied in a proportion of 1% of body weight/day. During the day, the herd was kept in pasture and at night in a sheepfold, along with approximately 70 ewes and 15 lambs. There were approximately 18 rams in another pasture and sheepfold. Water was provided *ad libitum* by an artificial drinking fountain.

During the physical examination, the lamb was alert, presenting a body condition of 7 (scale 1-9), heart rate of 60 bpm, respiratory rate of 20 mpm, pink mucosa, capillary perfusion of 2 s, rectal temperature of 39°C, and normomotility on abdominal auscultation.

In both eyes, lens presented opacity (Figures 1 and 2) and reduced corneal reflex, pupillary reflex to

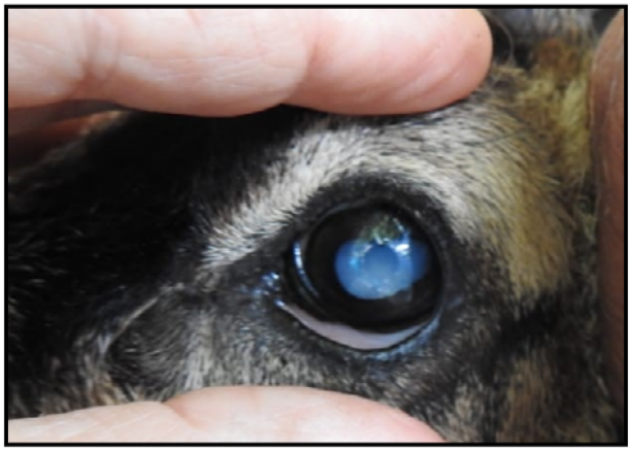

Figure 1. The left eye of a Blackbelly lamb with crystalline opacity.

Figure 2. The right eye of a Blackbelly lamb with crystalline opacity.

direct light, pupillary reflex to consensual light, and threat reflex. When walking, the lamb bumped into small objects or objects which were very close to his vision field (such as feeding buckets), but managed to follow the herd and dodge large objects (e.g., gates and fences), suggesting partial vision loss.

Complementary tests were performed, including ultrasonography and blood examination. Ultrasonographic examination using a 12 mHz linear probe[1] revealed a hyperchogenic lens (Figures 3 and 4), with no alterations in other ocular structures. The hematological and leukocyte parameters were within physiological limits.

Since the goal of Embrapa is genetic variability and conservation, during the breeding season, the females were divided into small groups (5-6 ewes each) and kept with different rams (1 ram per group). In this herd, cases of bilateral cataracts had already been diagnosed in adults and elderly (2 rams and 1 ewe, aged over 6 years), and this was attributed to aging. However, when analyzing the genealogy, it was found that 1 ram was the lamb's grandfather. The other affected ram had a daughter, which also presented crystalline opacity.

Based on history, physical examination, and complementary examinations, the lamb was diagnosed with bilateral congenital cataracts with a probable

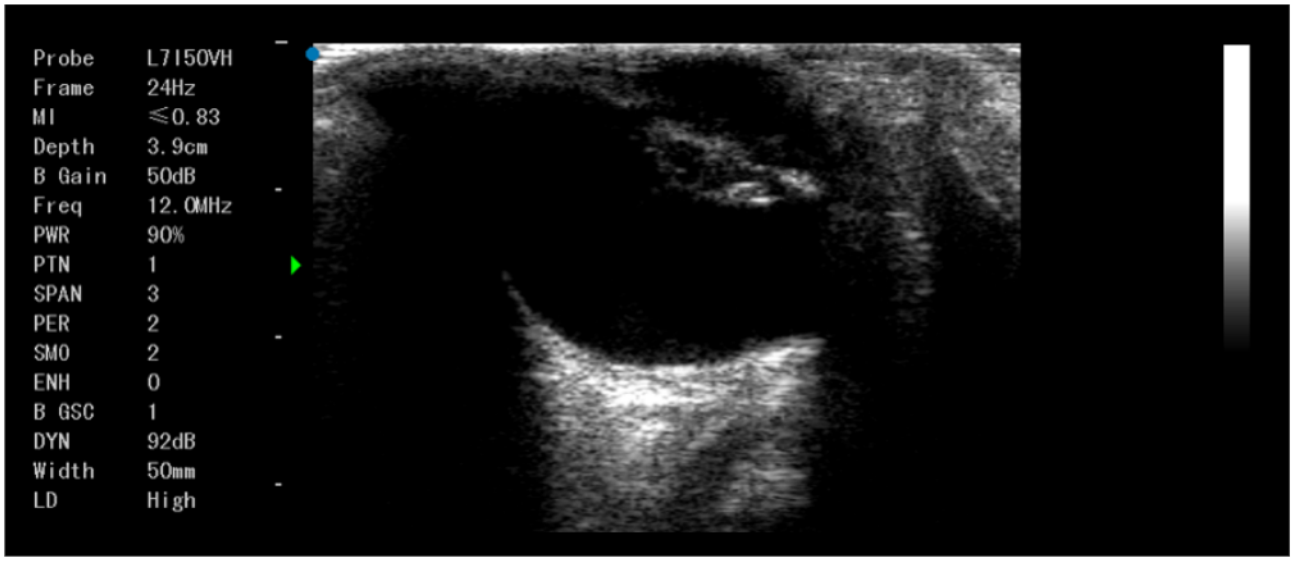

Figure 3. Ultrasonography examination of left eye of a Blackbelly lamb with bilateral congenital lens opacity.

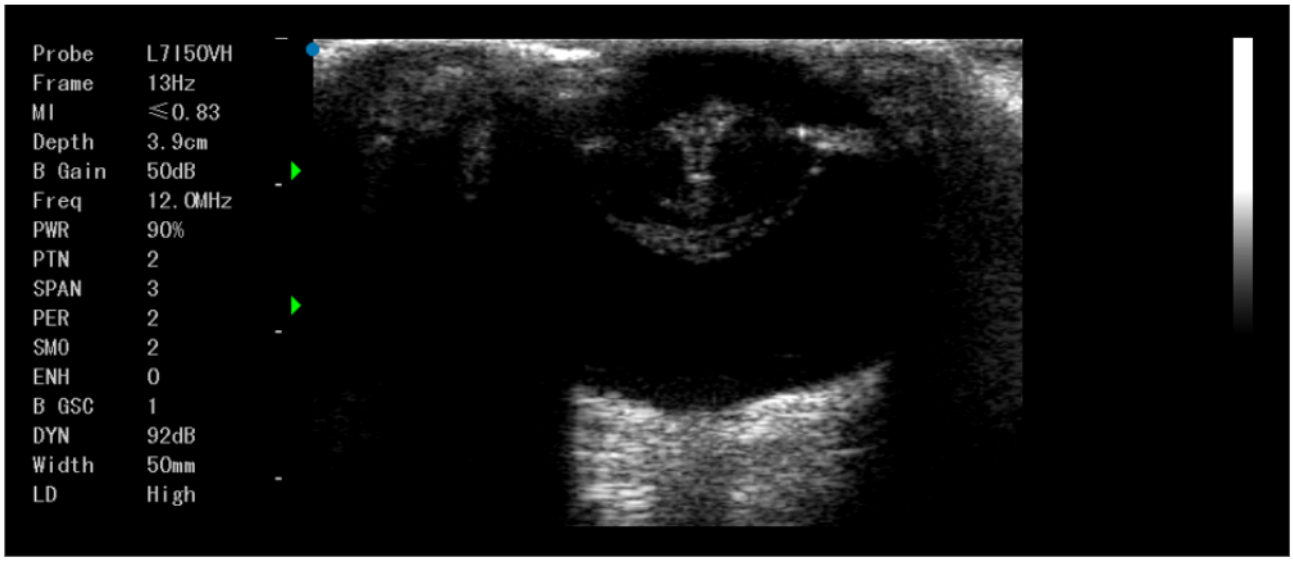

Figure 4. Ultrasonography examination of the right eye of a Blackbelly lamb with bilateral congenital lens opacities.

hereditary condition. Orchiectomy was recommended, and the patient's relatives were removed from reproduction.

DISCUSSION

Multiple factors can be related to the etiology of cataracts, including drugs, intoxication, radiation, traumatic injury, infection, inflammation, metabolic alterations, nutritional deficiencies, age, and genetics [3,8].

Excessive use and high doses (above the therapeutic recommendation) of antibiotics, corticosteroids, mitotic agents, allopurinol, chloroquine, amiodarone, and chlorpromazine can induce cataracts [6]. UV-B radiation from sunlight, infrared radiation, and radiation used for neoplasm treatment are agents with potential cataractogenesis effects [6], as well as traumatic injuries [14]. Septicemia and ocular infections can lead to uveitis, followed by lens opacity [1]. Metabolic alterations can include hypocalcemia, hypercupremia, hypoparathyroidism, and diabetes [14]. Hyperglycemia is associated with protein modification in the lens [17], with acute and bilateral development of diabetic cataracts.

Diabetes mellitus is a relatively common disease in humans, dogs, and cats, but is rare in sheep. This disease was reported in 2 Texel rams, 6.5 months old, born from the same ewe, with a history of growth retardation, poor body score, polydipsia, polyuria, slightly distended abdomens, and incipient cataracts [13]. Laboratory findings of glucosuria, ketonuria, hyperglycemia, and glucose intolerance confirmed the diagnosis and were associated with histological findings after necropsy [13]. Cataracts are one of the most common and important complications of diabetes in dogs, and a retrospective study reported a prevalence rate of 68% [18], however, juvenile diabetes mellitus has rarely been reported [2,7].

Regarding the age of onset, cataracts can be classified mainly as congenital and senile. Senile cataract is a bilateral opacification process that involves the entire lens, with slow progression and gradual loss of vision as age increases [8]. In adult sheep, the high proportion of eyes affected by spontaneously arising cataracts could be related to age, increased exposure to sunlight, increased genetic susceptibility, or a combination of these factors [16].

In the present case, the herd had 3 elderly sheep with cataracts previously characterized as senile. However, after reviewing the genealogy, it was found that all animals had some degree of parentage, suggesting a hereditary factor. Congenital cataracts are present at birth, resulting from the malformation of fibers in the lens, and are generally nonprogressive. Congenital forms may or may not be associated with hereditary factors [8]. Inheriting cataracts have been reported in several breeds of dogs and occur as an autosomal recessive trait [8].

In cattle, an outbreak of congenital cataracts was attributed to infection with bovine viral diarrhea (BVD), although this has not been definitively confirmed [12]. The main ocular defects described in the literature due to BVD include retinal atrophy or dysplasia, microphthalmia, and cataracts [20].

Bilateral congenital cataracts are often associated with systemic diseases, infectious factors, and genetic variation in humans. Inherited congenital cataracts have been linked to mutations in particular genes, including crystalline, membrane transport channel proteins, gap junction proteins, development transcriptional factors, and the cytoskeleton. The genesis of congenital cataracts is still not well understood and very little has been identified due to the lack of modern techniques, accurate long-term data required, and intense investigative techniques [11].

Developmental and congenital bilateral cataracts have been reported in several horse breeds; however, to date, no causal mutations have been identified. Pedigree analysis suggests different modes of inheritance by breed; therefore, multiple genetic mechanisms are likely. In Morgan horses, pedigree analysis of congenital nuclear cataracts suggests a dominant mode of inheritance that is influenced by sex, with females being more severely affected [4]. In Exmoor ponies, a sex-linked mode of inheritance has been proposed [15].

Hereditary cataracts constitute about 22.3% of global childhood cataracts [19], classified in inherited as autosomal dominant (most frequent), autosomal recessive, or X-linked traits. In sheep, the first description of inherited cataracts in New Zealand Romney sheep was classified as a simple autosomal dominant trait [5]. In this report, the lamb's grandfather had a history of cataract development, and another ram had a daughter who developed cataracts. This suggests that genetic factors influence the onset of ocular alterations in this herd.

To control this ophthalmic alteration, orchiectomy of the affected lamb is recommended and the removal of his parents and grandparents from reproduction. The other ram and his respective daughter, which had cataracts and where not the lamb's relatives, were also removed from breeding. Alternatively, in the next breeding season, the female/male (with lens opacity) could be mated with a different breeder and the offspring should be monitored for any opacity in the lens. However, this would be riskier because both rams and ewes could be cataractous. In Brazil, there are few Blackbelly herds; therefore, consanguinity is common and can exacerbate alterations related to genetic inheritance.

Autosomal recessive diseases are difficult to control and are of potential importance in pedigree breeding, while those with dominant patterns of inheritance are easier to recognize and control, mainly by culling affected animals [5] or castration. In the present report, the lamb may have inherited congenital cataracts, since at least 1 of its grandparents also presented lens opacity. The lamb presented with cataracts after birth, but his relatives presented only after adulthood.

To the best of our knowledge, this is the first report of bilateral congenital cataracts in a Blackbelly lamb associated with inheritance potential. Definitive identification of the etiology of crystalline opacity in sheep is challenging. Cataract treatment is surgical; however, farm animal surgery is generally limited due to the cost, availability of equipment, and efficiency of the procedure. Under field conditions, the main recommendation is that sheep carrying genes related to hereditary cataracts should be excluded from reproduction.

Soon after birth, the Blackbelly lamb presented bilateral lens opacity with partial loss of vision and was diagnosed with a congenital cataract. After clinical and genealogical evaluation, we believe that his cataract was hereditary. The Blackbelly breed is rare in Brazil, and herds can present high rates of consanguinity. To control this disease, we recommended removing his ancestors (parents and grandparents) from reproduction, as well as the lamb itself. Therefore, monitoring is required to identify future cases.

MANUFACTURER

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