Cryptosporidial Diarrhea in Neonatal Lambs: A Clinical Investigation in an Industrial Flock in Iran

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Abstract

Background: Cryptosporidiosis is a protozoan infection that causes severe diarrhea in young ruminants. In sheep production systems, especially under industrial conditions, cryptosporidial diarrhea can lead to high neonatal mortality and substantial financial loss. This study investigates an outbreak of cryptosporidial diarrhea in a neonatal lamb population within a large commercial unit, focusing on clinical signs, pathogen identification, environmental factors, and control measures.

Methods Clinical and environmental assessments were conducted at the affected site. Fecal and umbilical samples were collected from lambs between 5 and 10 days old, and analyzed using flotation techniques and bacterial culture. Management practices were simultaneously evaluated to identify risk factors.

Results: Clinical observations included watery yellow diarrhea, dehydration, and inflamed navels. Parasitological analysis confirmed the presence of *Cryptosporidium parvum* oocysts, while bacteriology revealed *Klebsiella* spp. Environmental factors such as damp bedding and poor disinfection practices were conducive to disease spread. Supportive fluid therapy and improved hygiene protocols were implemented as part of outbreak control. No curative treatment for cryptosporidiosis was available, but the use of disinfectants such as formalin and ammonia showed environmental efficacy.

Conclusion: Cryptosporidiosis, compounded by bacterial co-infections like *Klebsiella*, is a serious threat to neonatal lamb health in intensive production systems. An integrated approach that includes early detection, environmental management, effective colostrum intake, and staff training is essential. Given the zoonotic nature of Cryptosporidium, biosecurity measures for farm personnel are also critical.

Keywords: *Cryptosporidium parvum*, Lamb diarrhea, *Klebsiella*, Neonatal infection, Colostrum, Zoonosis.

Introduction:

Diarrhea in newborn lambs is a leading cause of morbidity and mortality, particularly in industrialized sheep operations with high animal density. The causative agents are often multifactorial, including viral, bacterial, and parasitic pathogens. Among parasitic causes, *Cryptosporidium parvum* has gained prominence due to its widespread environmental presence, resistance to conventional disinfectants, and significant zoonotic potential (1, 2).

C. parvum infects the epithelial cells of the small intestine, leading to villus atrophy, malabsorption, and watery diarrhea. Oocysts are excreted in high numbers—up to 10^7 per gram of feces—and are highly resilient, surviving in cool, moist environments for extended periods (3). These oocysts are notably resistant to standard sanitation practices, including chlorine and iodine solutions (4, 5). As a result, outbreaks can persist in contaminated environments despite routine hygiene procedures. In Iran, while several studies have addressed cryptosporidiosis in calves, documentation in lamb populations remains limited. This report investigates a neonatal diarrhea outbreak in lambs, emphasizing the diagnostic process and management strategies to control *Cryptosporidium* in a high-risk setting.

Materials and Methods:

The outbreak occurred in June 2025 at a large sheep farm in northeastern Iran. The farm operated under intensive conditions, housing several hundred ewes and their newborn lambs. Lambs were separated from their dams shortly after birth and reared in indoor pens with shared feeding and bedding systems.

During the investigation, lambs aged 5 to 10 days presenting with diarrhea were clinically examined. Key observations included fecal consistency, signs of dehydration, and the status of the umbilical area. Fresh fecal samples were collected rectally and examined using modified flotation techniques for the detection of Cryptosporidium oocysts. Umbilical swabs were cultured on selective media for bacterial identification, specifically targeting *Klebsiella spp.* and *Escherichia coli*.

In parallel, farm management practices were evaluated. Investigators reviewed lambing protocols, colostrum feeding timing and volume, housing hygiene, and navel disinfection routines. Ventilation, bedding moisture, and overall pen sanitation were assessed to identify environmental contributors to disease spread.

Results and Discussion:

Affected lambs exhibited profuse watery yellow diarrhea, moderate dehydration, and noticeable navel swelling, which persisted despite the routine use of iodine-based disinfectants.

Fecal testing confirmed a heavy burden of *C. parvum* oocysts, consistent with earlier reports describing cryptosporidiosis as a leading cause of neonatal diarrhea in ruminants (1, 2, 3).

Bacterial culture identified *Klebsiella spp.* in both fecal and umbilical samples. The co-presence of *Klebsiella* with *Cryptosporidium* suggests a synergistic relationship where protozoal infection compromises intestinal mucosa, facilitating bacterial colonization and systemic spread (2, 4). *Klebsiella* is known to cause navel ill and may lead to septicemia in neonates, particularly when umbilical disinfection is incomplete or improperly applied (2, 5).

The environmental assessment revealed several risk factors that facilitated disease persistence. Pens were overcrowded and poorly ventilated, with bedding often damp and contaminated with feces. These conditions are ideal for the prolonged survival and spread of Cryptosporidium oocysts (3,6). The disinfectants used for umbilical care were iodine-based, which are insufficient against resistant oocysts and possibly ineffective against the strains of Klebsiella present on the farm.

As no curative treatment for cryptosporidiosis currently exists, management centered on supportive therapy. Affected lambs received oral and intravenous fluid therapy to correct dehydration, which is the primary cause of death in such cases (9). Selective antibiotic therapy was administered to lambs with systemic signs of infection, with florfenicol and ceftiofur showing moderate efficacy against *Klebsiella* isolates in the region (2).

Control of environmental contamination was addressed by switching to disinfectants known to be effective against oocysts, particularly 10% formalin and 5% ammonia, which have been shown to reduce oocyst viability in similar outbreaks (4, 5). These were used in combination with improved drying and cleaning protocols to reduce environmental persistence. Feeding tools, pens, and bedding were routinely disinfected and allowed to dry, as oocysts are susceptible to desiccation (5).

In response to the outbreak, several long-term interventions were introduced. Colostrum management was prioritized, ensuring that each lamb received at least 10 to 15 percent of its body weight in high-quality colostrum within six hours of birth. Adequate passive immunity is critical in protecting neonates from both cryptosporidial and bacterial pathogens (2, 8).

Vaccination programs for ewes were reviewed and updated. Pre-lambing immunizations were reinforced to cover *E. coli*, rotavirus, and clostridial diseases, aiming to enhance maternal antibody transfer via colostrum (2). Although no commercial vaccine exists for *Cryptosporidium*, maternal health and immunity play an important role in mitigating the early severity of infection.

Improved hygiene practices were introduced across the facility. These included daily cleaning of pens, enhanced bedding management, and use of disinfectants with proven efficacy against Cryptosporidium oocysts (5,6). Biosecurity measures were also strengthened. Staff were

trained on the zoonotic risk of Cryptosporidium, and use of gloves, handwashing, and protective clothing became mandatory during outbreak periods (11). Equipment was disinfected between uses, and rodent control programs were intensified to eliminate environmental contamination reservoirs.

Continuous monitoring and data recording were implemented to allow for early detection in future outbreaks. Fecal sampling became a routine protocol during the first weeks of life, and all diarrhea cases were tracked and linked to management interventions to assess effectiveness over time.

This outbreak investigation highlights the critical role of *Cryptosporidium parvum* in neonatal lamb diarrhea and emphasizes the complexity added by bacterial co-infections such as *Klebsiella spp.* The findings support the need for comprehensive farm management, including proper colostrum administration, environmental disinfection, and consistent hygiene protocols. As no specific treatments for cryptosporidiosis exist, early supportive care and biosecurity remain the most effective tools for controlling mortality. Given the zoonotic nature of the disease, protective measures for farm workers are equally essential. These findings provide practical guidance for other intensive sheep operations confronting similar challenges.

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