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# DIARRHEAL PATHOGENS IN CALVES AND RISK FACTORS FOR INFECTION IN PERI-URBAN AND PASTORALIST PRODUCTION SYSTEMS IN ETHIOPIA

### Summary

**Diarrheal disease in young calves is a leading cause of morbidity and mortality across the major livestock production systems in Ethiopia. Basic improvements in livestock husbandry, housing hygiene and neonatal care practices, particularly improving colostrum feeding in newborn animals, are recommended as firstline interventions to reduce morbidity and mortality from common diarrheal pathogens such as *Cryptosporidium parvum* and Enterotoxigenic *Escherichia coli* ETEC/K99, bovine rotavirus and bovine coronavirus.** Disease specific interventions such as vaccination are unlikely to yield desired reduction in morbidity and mortality rates unless paired with fundamental improvements in livestock husbandry, farm hygiene, and feeding practices for colostrum (the first milk produced after birth; very rich in antibodies). The Ethiopian Ministry of Agriculture and Livestock Resources' National Young Stock Mortality (YSM) Reduction Packages provide thorough guidelines for extension workers and small holder farmers on improved practices; a particular focus on adoption of improved peripartum management, feeding of colostrum, farm hygiene, and housing has the potential to reduce morbidity and mortality in young stock and reduce exposure to zoonotic pathogens in people.

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#### Project Webpage:

- <https://livestocklab.ifas.ufl.edu/project/s/dr-woutrina-smith->

### Background

Led by the University of California, Davis, in collaboration with Aklilu Lemma Institute of Pathobiology, Addis Ababa University, University of Gondar, and the National Animal Health Diagnostic and Investigation Center, the **Addressing Young Stock Mortality in Smallholder Farms and Pastoral Herds of Ethiopia** study generated new epidemiological information on the major causative agents and risk factors for diarrheal disease leading to young stock morbidity and mortality in Ethiopia. Across production systems in Ethiopia, young stock morbidity and mortality rates are high, which constrains livestock production, reduces incomes and negatively impacts livelihood improvement. It is estimated that 20% calf mortality results in 38% profit reduction for a livestock farm in Ethiopia.<sup>1</sup> Reduction of young stock mortality through improvements in animal health is a national priority outlined in the 2015-2020 Ethiopian Livestock Master Plan, part of the Growth and Transformation Plan II.

Multiple cross sectional and longitudinal studies conducted in Ethiopia over the last 20 years have reported young stock mortality rates ranging from 5-30% and morbidity rates as high as 66%, with the majority of findings representing peri-urban dairy farms. While these statistics vary across production system, season, and region, they reflect major challenges to continued growth and productivity of the Ethiopian livestock sector. Furthermore, many of these studies cited diarrheal diseases as the leading cause of morbidity and mortality in calves. In 2016, Fentie and colleagues reported mortality rates of 15-25% in peri-urban, 9-14% in mixed crop-livestock and 26-29% in pastoralist calves, with diarrhea related causes driving 63%, 34%, and 18% of mortality, respectively.<sup>2</sup> In 2019, a YSM Reduction Package intervention baseline survey, conducted by Addis Ababa University's College of Veterinary Medicine and Agriculture

and the Supporting Evidence Based Interventions project in the same areas as the present study, reported mortality rates of 21% in peri-urban, 10% in mixed crop-livestock and 32% in pastoralist production systems, with 18%, 14% and 29% of calves respectively, suffering from diarrhea in the preceding 12 months.<sup>3</sup> **This brief focuses on the most common enteric pathogens and risk factors related specifically to diarrheal diseases in calves less than six months of age.**

## Approach

From 2017-2019, this cross-sectional study enrolled 833 diarrheic and asymptomatic calves (479 peri-urban dairy calves from Gondar and Sululta districts; 354 calves from pastoral areas (Awash district), performed 353 producer surveys to assess farm, herd and individual level risk factors, and conducted 1,254 diagnostic tests to detect various enteric pathogens and assess failure of passive transfer. Laboratory diagnostic tests utilized included the Pathasure® Enteritis 4 enzyme-linked immunosorbent assay<sup>4</sup>, bacterial culture, and radial immunodiffusion assay<sup>5</sup>. Preliminary risk factor analyses were conducted to evaluate farm, herd, and individual animal risk factors.

## Results

**Table 1: Enteric Pathogen Prevalence in Calves <6 months of age (%)\***

	<i>Salmonella</i> spp.	<i>E. coli</i> ETEC/K99	<i>Cryptosporidium parvum</i>	Bovine Rotavirus	Bovine Coronavirus
Peri-urban	3.2%	13.6%	34.1%	7.5%	5.8%
Pastoral	5%	20.3%	39.3%	15.5%	23.2%

\*Positive test results comprise both single and co-infections.

## Evidence-Informed Recommendations

This study confirmed that a variety of pathogens cause diarrhea in young calves in Ethiopia. These findings are consistent with the leading causes of diarrhea in calves around the world. ***Cryptosporidium parvum* infection was the most common diarrheal pathogen identified in both production systems and is also a zoonotic pathogen capable of causing diarrhea in children and adults** (Table 1). Co-infection with multiple pathogens was found in a subset of calves, with *E. coli* ETEC/K99 and *C. parvum* co-infection the most frequent. Calves in peri-urban and pastoral systems had high prevalence (24 and 25%, respectively) of failure of passive transfer of colostrum antibodies. Identified risk factors for positive enteric pathogen test results include late or failed colostrum feeding, dystocia or poor vigor at birth, housing type and housing hygiene.

**Calf diarrhea is a multi-factorial disease and evidence from this project suggests improving producer knowledge and practices regarding colostrum feeding and other key risk factors such as farm hygiene and husbandry practices should be the primary measures taken to address young stock mortality and morbidity due to diarrheal diseases.** Passive transfer of immunity following dam vaccination is only successful when the calf consumes adequate and quality colostrum in the first 24 hours after birth, thus recommending dam vaccination without addressing colostrum feeding practices is unlikely to yield desired reductions in diarrheal associated morbidity and mortality resulting from enteric pathogen specific vaccinations. Improved farm hygiene management could be especially effective for reducing *C. parvum* exposure on farms for both livestock and humans.

## References

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