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ADDRESSING YOUNGSTOCK MORTALITY IN SMALLHOLDER FARMS AND PASTORAL HERDS OF ETHIOPIA

PI: Professor Woutrina Smith, University of California, Davis, USA

Co-PIs:

Dr. Nigatu Kebede, Aklilu Lemma Institute of Pathobiology, Addis Ababa University, Ethiopia

Dr. Tsegaw Fentie, University of Gondar, Ethiopia

Dr. Getnet Abie, National Animal Health Diagnostic and Investigation Center (NAHDIC)

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INTRODUCTION

- Ethiopian livestock is a means of livelihood for over 85% of crop-livestock farmers & over 22 million pastoralists
- Key contribution for ***sustainable food security*** & ***poverty reduction***
- Livestock productivity in Ethiopia is generally low due to ***uncontrolled animal diseases, low genetic quality of local breeds, poor husbandry*** and ***inadequate infrastructure***

MoA - Livestock Master Plan (2015-2020)

- Aimed at increasing ***milk*** & ***red meat production***

The livestock production systems in Ethiopia are challenged by *severe mortality* and *low replacement stock*. Young livestock mortality is the one of the largest contributors to the limited *herd expansions* and *genetic improvements* in Ethiopia

Mean annual calf mortality in Ethiopia is reported as (Fentie et al., 2016)

- 12-21% in mixed crop-livestock
- 27% in urban and peri-urban dairy
- 42% in pastoral production systems

STUDY JUSTIFICATION

- ***Disease*** and ***malnutrition*** are major causes of young stock mortality
- Among which:
  - 32-61% of calf mortality is due to ***diarrhea/calf scours***
  - 2 - 42% of calf mortality is due to ***respiratory disorders/pneumonia***

- **It is estimated that 20% calf mortality could result in 38% reduction of profit for dairy farms**

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DIARRHEAL DISEASE

- Diarrheal disease is a major cause of mortality in the first 30 days of life
- Clinical signs are similar and so require diagnostic testing that can differentiate between major pathogens (e.g. Pathasure Indirect ELISA)

Pathogen	Age at Onset	Sample Specimen	Diagnostic Test	Species
E. coli (ETEC, K99)	0 to 4 days	Fresh feces	Antigen ELISA (Pathasure)	Calves
Rotavirus	5 to 15 days	Fresh feces	Antigen ELISA (Pathasure)	Calves
Coronavirus	5 to 30 days	Fresh feces	Antigen ELISA (Pathasure)	Calves
Salmonella	5 to 14 days, anytime	Fresh feces, swab	Fecal culture	Calves, Lambs, Kids
Cryptosporidium	7 to 28 days	Fresh feces	Antigen ELISA (Pathasure), fecal flotation, acid fast	Calves, Lambs, Kids
Coccidiosis	> 21 days	Fresh feces	Fecal flotation	Calves, Lambs, Kids

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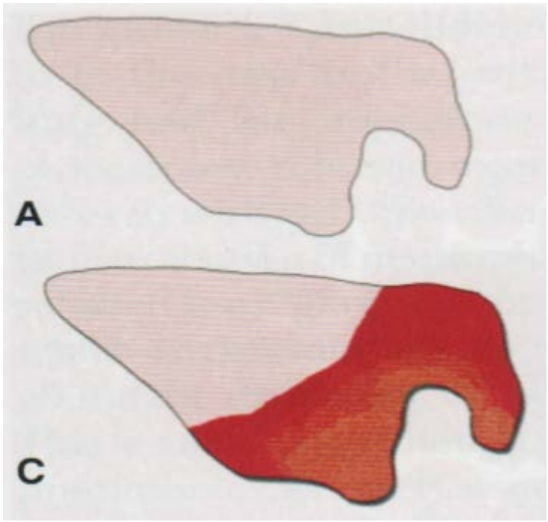
RESPIRATORY DISEASE

- Significant cause of morbidity/mortality in calves > 30 days of age, tends to affect older small ruminants more
- Both bacterial and viral agents play a role in respiratory disease
- Susceptibility based on interaction between host, environment, pathogen
  - Colostral antibodies important in protecting neonatal calves with successful passive transfer
  - Commensal bacterial (*M. hemolytica, P. multocida, H. somni, M. bovis/ovipneumonia*) cause opportunistic infection after viral infection
  - Stress, dust, dehydration and infection with respiratory virus make animals more susceptible to infection and difficulty clearing infection

Bronchopneumonia

- Infectious
  - Commensal bacteria (already present in the upper respiratory tract)
    - *Pasteurella multocida*
    - *Mannheimia hemolytica*
    - *Histophilus somni*
    - *Mycoplasma bovis/ovipneumonia*
- Non-infectious
  - Aspiration
    - Colostrum, milk, milk replacer, oral hydration fluids, etc.

Picture provided by Dr. Munashe Chigerwe, UCD



BACTERIAL RESPIRATORY PATHOGENS

Pathogen	Age at Onset	Sample Specimen	Species	Diagnostic Test
Pasteurella multocida	Commensal (opportunistic), any age	Deep nasopharyngeal swab/ rostral swab	Cattle, sheep, goats	Bacterial culture
Mannheimia hemolytica	Commensal (opportunistic), any age	Deep nasopharyngeal swab	Cattle, sheep, goats	Bacterial culture
Histophilus somni	Commensal (opportunistic), any age	Deep nasopharyngeal swab	Cattle, sheep, goats	Bacterial culture

Respiratory Pathogen	Age at Onset	Sample Specimen	Species	Diagnostic Test
Bovine respiratory syncytial virus (BRSV)	Typically > 30 days, but neonates also at risk if insufficient colostral antibodies	Deep nasopharyngeal swab or rostral swab; serum	Cattle	Serology with concurrent respiratory symptoms
Bovine herpesvirus 1 (Infectious bovine rhinotracheitis)	Typically > 30 days, but neonates also at risk if insufficient colostral antibodies	Deep nasopharyngeal swab or rostral swab; serum	Cattle	Serology with concurrent respiratory symptoms
Bovine viral diarrhea virus (BVD)	Typically > 30 days, but neonates also at risk if insufficient colostral antibodies	Deep nasopharyngeal swab or rostral swab; serum	Cattle	Ear-notch and Antigen capture ELISA with repeat testing in 3 wks for +
Parainfluenza virus-3 (PI-3)	Typically > 30 days, but neonates also at risk if insufficient colostral antibodies	Deep nasopharyngeal swab or rostral swab; serum	Cattle	Serology with concurrent respiratory symptoms

- **Study Objective:**

  To generate new epidemiological information on the major causes of young stock morbidity and mortality that hampers the productivity of livestock in Ethiopia, and evaluate government-planned intervention strategies

- **Specific Aims:**

1. Collect **epidemiologic data** on young stock management, farm factors, feed resources, livestock disease, and socio-demography of livestock producers.
2. Assess farm-level and animal-level **risk factors** for young stock mortality in Ethiopia.
3. Evaluate **intervention strategies** for reduction of young stock losses that align with the Ministry of Agriculture and Livestock Master Plan.
4. Build **human and institutional diagnostic and research capacities** at Addis Ababa University, University of Gondar, and the National Animal Health Diagnostic and Investigation Center.
5. Provide **training** to extension officers, livestock keepers, and prioritize involvement of women in all study components.

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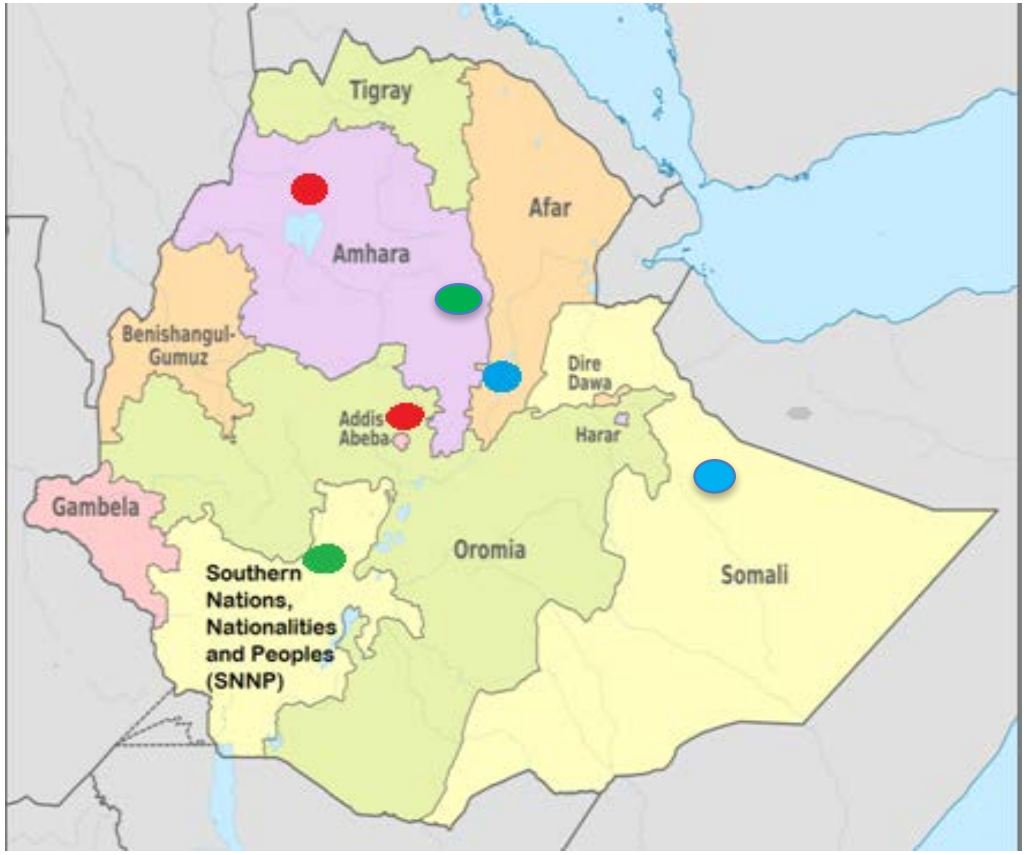
STUDY AREAS IN ETHIOPIA



- Peri-urban dairy system (Sululta & Gondar)
- Mixed production system (Dalocha & Siayedeber)
- Pastoral production system (Awash Fentale & Fafen)

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METHODS

- Cross-sectional and longitudinal sampling of animals less than 6 months old
- Four districts (REACH) and 2 districts (Tufts), with 3 kebeles per selected district
- Cattle, sheep, goats from dairy, mixed crop-livestock, and/or pastoral systems
- Farm and young livestock enrollment
  - Farmer questionnaire: identify risk factors and mortality rates
  - Animal enrollment: physical examination, respiratory and fecal score
  - Standardized sample collection: blood, diarrhea, and respiratory swabs
- Laboratory diagnostics (parasitology, bacteriology, serology, and virology)
- Sample storage for long-term bio-banking of collected specimens
- Analysis of risk factor and disease etiology data performed by consortium partners using descriptive statistics and regression models

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HEALTH INTERVENTION EVALUATION FOR REDUCTION OF YOUNG STOCK MORTALITY

- Minimum Intervention Packages developed (animal species and production system specific)
- Result framework developed with the assistance of SEBI U of Edinburgh, for monitoring and evaluation
- Questionnaire formats developed and tested for pre- and post-intervention surveys
- 24 data collectors were identified and trained
- 18 livestock extension agents (one/kebele) trained on intervention packages
- 150 participant farmers/district identified from each study region
- Pre-intervention survey to be undertaken in coming months

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Calf Intervention Package (Dairy system)

Management and Husbandry Related Interventions

Intervention 1: Improving farm cleanliness

Intervention 2: Prenatal care of the dam

Intervention 3: Neonatal care of the calves

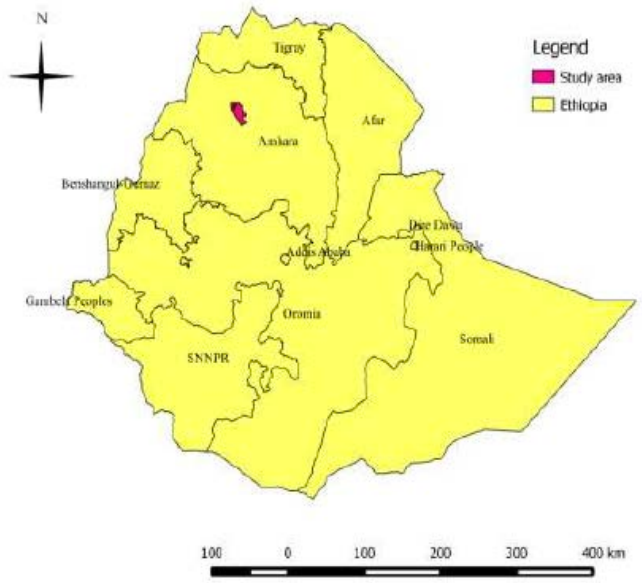
Intervention 4: Pre-weaning feeding management of the calves

Health Related Interventions

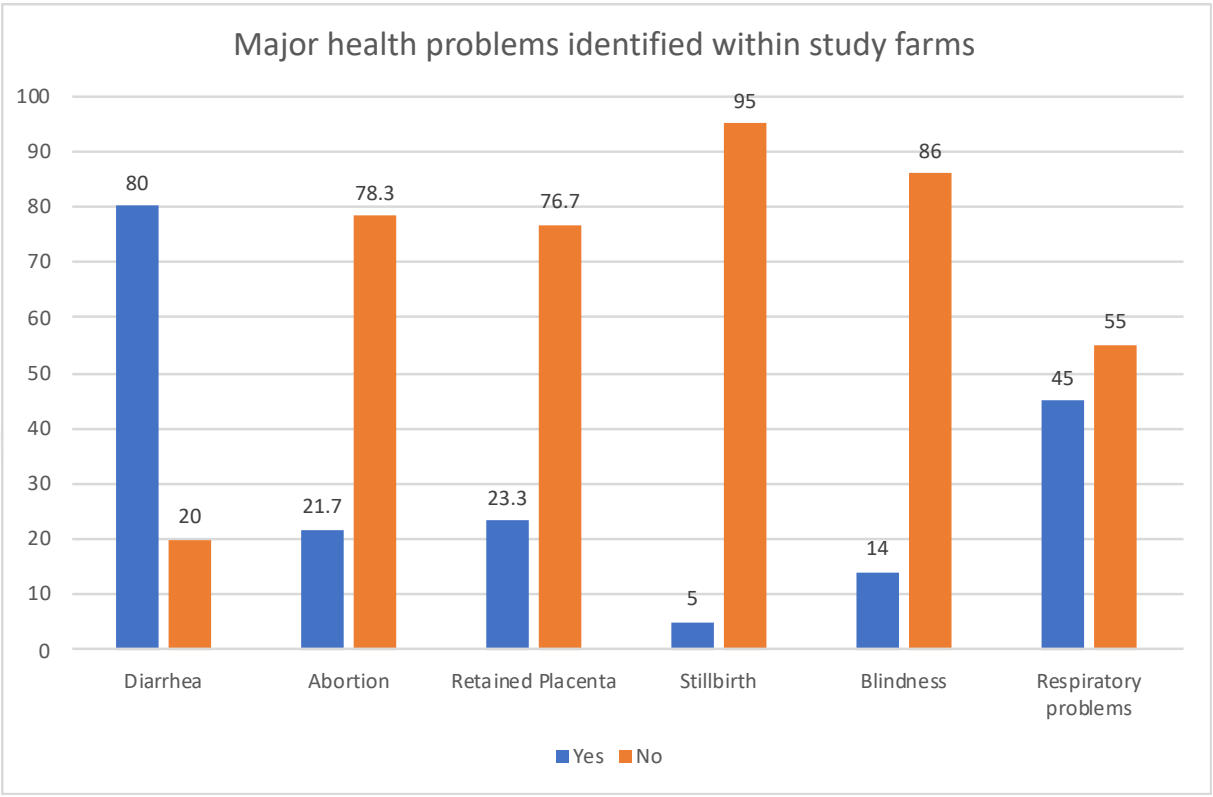
Intervention 1: Prevention and control of calf diarrhea

Intervention 2: Prevention and control of pneumonia

GONDAR DAIRY LIVESTOCK SYSTEM



Map of study area (QGIS software 2.18 and OCHA, 2016)



Data source: Endeshaw Demil, Seroprevalence and factors associated with bovine viral diarrhea in dairy cattle in and around Gondar town, Ethiopia. University of Gondar, thesis, 2018.

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PATHOGEN RISK FACTORS

Risk Factor	*Cryptosporidium parvum*	*Eimeria*	*E. coli* K99	Rotavirus	Bovine Viral Diarrhea Virus
Calf age		X	X		X
Late colostrum feeding			X	X	
Dystocia or low vigor at birth			X		
Farm management system		X			X
Housing type		X	X		
Farm hygiene		X			X
Water source	X		X		

HEALTH RECOMMENDATIONS

- Diagnostics of diarrheal problems is recommended to focus treatment and reduce the usage of antibiotics
- Improve hygiene as part of livestock management practices
- Improve colostrum feeding practices
- Provide adequate calving facilities
- BVDV:
  - Test new additions prior introduction into the herd and implement quarantine practices
  - Isolate sick animals
  - Test for PI animals to control disease transmission
- Further epidemiological studies are needed

NEXT STEPS FOR GONDAR

Sample	Pathogen	Method	No. Farms up to February	No. Samples up to February	Goal
Fecal	*E. coli* K99 *Cryptosporidium parvum* Bovine Coronavirus Bovine Rotavirus	Pathasure ELISA kit	26	80	150 farms
Nasal swab	*Pasteurella multocida* *Mannheimia haemolytica*	Bacteriological culture and identification	26	80	150 farms
Serum	Failure of Immune Passive Transfer	RID plates	26	80	150 farms
	BRSV PI-3	ELISA	26	80	150 farms
	BVDV	ELISA / rt-PCR	26	80	150 farms

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NEXT STEPS FOR GONDAR








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NEXT STEPS FOR AAU

Prod. System	Pathogen	Method	No. Farms up to February	No. Samples up to February	Goal
Peri-urban dairy system (Sululta)	*E. coli* K99 *Cryptosporidium parvum* Bovine Coronavirus Bovine Rotavirus	Pathasure ELISA kit	100	100	150 farms
	Gastrointestinal parasites	Fecal flotation	100	100	150 farms
Mixed crop-livestock (Dalocha)	*Salmonella* and *E. coli* K99	Bacteriological culture and identification	150	90	150 farms
	Gastrointestinal parasites	Fecal flotation	150	92	150 farms
	BVDV	ELISA / rt-PCR	0	0	150 farms
Pastoral system (Awash)	*Salmonella* and *E. coli* K99	Bacteriological culture and identification	90	100	150 farms
	Failure of passive transfer (IgG) (lambs/kids, and calves)	Radial immunodiffusion (RID)	90	92	150 farms
	BVDV	ELISA / rt-PCR	0	0	150 farms

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LESSONS LEARNED AND CHALLENGES

- Overall, more than 1100 animals were sampled and 2800 tests were run, involving capacity building at multiple institutions in Ethiopia
- Students are motivated and enthusiastic to learn and participate, with 4 female and 19 male Ethiopian students included in project activities
- Colostrum feeding and hygiene practices should be prioritized for health intervention evaluation to reduce young livestock sickness and death
- Supply chain to obtain research field and laboratory supplies is problematic
- Implementing standardized procedures for fieldwork, lab work, and data analysis across regions, stakeholder groups, and political change is difficult

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QUESTIONS & DISCUSSION

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