

Interventions and tools to improve small ruminant health in Ethiopia

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Key messages

- Involving gender in animal health research is important to understand the real extent of challenges faced by small ruminant producers.
- Capacity development and collaboration with scientists from the national agricultural research system (NARS) and extension providers helps target farmers facing animal disease challenges.
- Coordinated collaboration between laboratory and field research is crucial to the detection and identification of animal disease, control and prevention as it improves the delivery of quality and safe vaccines and other veterinary products to smallholder farmers.

Assessing challenges

Small ruminants contribute significantly to the livelihoods and food security of smallholders in Ethiopia. However, small ruminant productivity is very low and the contribution of disease to the problem is poorly understood. Thus, the CGIAR Research Program on Livestock and Fish, with national research institutions, tested several approaches and interventions to overcome the challenges facing small ruminant producers in Ethiopia.

Rapid value chain assessment

As part of the rapid value chain assessment (Legese et al. 2014) undertaken at the beginning of the program, scientists identified disease and **poor reproductive performance** as the major impediments to improving productivity. The findings clearly indicated that control of infectious diseases and husbandry practices were sub-optimal.

Systematic literature reviews

Systematic literature reviews on small ruminant disease showed very high prevalence of gastro-intestinal and metacystode parasites, including *Coenurus cerebralis* (*Taenia multiceps*), (Asmare et al. 2016a; 2016b; 2016c), highlighted the economic

impact of mange mite infections and vector-borne diseases, and identified research gaps in respiratory diseases, namely contagious caprine pleuropneumonia (CCPP) (Asmare et al. 2016d), pasteurellosis and peste des petits ruminants (PPR). A high prevalence of CCPP was reported in pastoralist production systems where *Mycoplasma capricolum* subsp. *capripneumoniae* (Mccp) was confirmed to be present.

The literature reviews found little data on reproductive diseases as previous research has tended to focus only on brucellosis and toxoplasmosis. Scientists examined reporting of outbreaks of PPR, CCPP and sheep and goat pox and found that the disease control responses had been inadequate, even though the strengthening of the para-veterinarian system seemed to have had a positive impact on disease detection. Moreover, there were significant regional variations in incidence and impact of diseases, reinforcing the need to develop context-specific control.

The impact of small ruminant diseases

As part of a survey on the economic, social, human health, and psychological impact of small ruminant diseases, scientists met with Alemtsehay Zenebe to discuss the production constraints she faces. Like many people living in the Ethiopian highlands, this young mother of four and household head relies on livestock farming. Her 10 sheep, a few cattle and a donkey are the main livelihood sources for her family.

By rearing sheep for meat, Alemtsehay makes ends meet. Her sheep also serve as insurance against crop failure or to pay for medicines and school fees for her children. For Alemtsehay, sheep are like 'money in the pocket', easy to sell in times of need. But she faces several challenges to sustain and improve her sheep, among which disease is crucial. Sheep and goat pox, respiratory infections and pasteurellosis are among the important diseases affecting her flock. The impact of her household is significant, with animal diseases leading to losses in income as well as reduced growth rates and weight gain in the animals. She also faces increased costs for medicines and time spent taking care of the animals.

In-depth assessments

With the NARS scientists, participatory and household surveys were undertaken to better understand the main small ruminant disease constraints, examine the priorities for men and women farmers and their involvement in disease management, and to assess the impacts of disease constraints as perceived by men and women. The first step involved capacity building on gender and participatory methods for NARS partners and the consequent development of a joint study protocol applied with 92 focus group discussions (FGDs) at the various sites. The same researchers then contributed to data analysis and interpretation of findings and development of a study protocol for a household survey involving around 650 men and women. The protocols were successfully applied and since then have also proved useful in other countries. In addition, a sero-survey on reproductive diseases, PPR and CCPP, and studies into food safety risks were undertaken.

Focus group discussions

The FGDs facilitated the collection of relevant information on small ruminant production, providing insights into why farmers prioritize diseases and what they know about them in terms of clinical signs and transmission pathways. Farmers identified several small ruminant diseases and syndromes by their local names. In highland areas (mixed crop–livestock system) respiratory diseases (pasteurellosis and CCPP) and GIT-parasites (liver fluke) were the priority challenges mentioned. In lowland areas, respiratory diseases, multi-systemic diseases—like PPR—and neurological diseases, particularly coenuroseis, were the top concern. Communities said that the magnitude of the disease impacts varied among household members, with general agreement that women are the most affected. The study also highlighted the role of small ruminants in protecting food security, particularly as perceived by women (Wieland et al. 2016).

Household and sero-surveys

The household survey examined the prevalence of major small ruminant disease constraints at the study sites and gendered perceptions of household members as to their involvement in the small ruminant health and management. Despite the gendering of roles, both men and women described the clinical signs of disease in live animals in very similar ways and made comparable observations regarding disease in carcasses of slaughtered animals. However, neither men nor women farmers displayed high levels of awareness of zoonotic diseases, e.g. anthrax and rabies, while food safety risks were not mentioned¹. Given the involvement of women in small ruminant production, there is untapped potential to increase their involvement in disease detection and the delivery of animal health services.

The assessments highlighted the importance of and poor management strategies for dealing with PPR, CCPP and parasitic diseases. The sero-survey found the antibody prevalence for PPR ranging from 2.3–20.6% in non-vaccinated areas. In vaccinated areas, there was evidence of good coverage with 90% antibody prevalence, but also areas with levels as low as 33%. Low vaccine coverage and a lack of thermostability of vaccines are likely to be contributing factors to the low protection levels observed. The antibody prevalence for CCPP—a severe diseases affecting small ruminants causing major financial losses—was 48% in

vaccinated areas, lower than expected and insufficient to stop disease transmission. A herd immunity level of 80% and above is required for adequate CCPP control.

A sero-survey on potential pathogens linked to poor reproductive performance was also conducted in highland sites. This found high sero-prevalence of for *Chlamydia* spp. 57.9%, for Q-fever 38% and for *Toxoplasma gondii* 39.8%, which also constitute potential public health risks. Conversely, samples tested negative for *Brucella* spp. and border disease virus.

Food safety and security

The potential role of small ruminants in protecting food security attracted the attention of researchers seeking to improve understanding of related food safety risks and consumption habits in Ethiopia. More specifically, goat milk consumption was known to be a particularly important pathway to improve nutrition, especially of children. Research revealed that communities were aware of the benefits of milk consumption (Dewé et al. 2014; Amenu et al. 2016). In collaboration with Agriculture for Nutrition and Health CRP and the ILRI Safe Food Fair Food project, scientists identified three key constraints to consumption in Ethiopia: low incomes, poor animal productivity and abstinence due to religious fasting (Szonyi et al. 2014).

Other food safety issues associated with the consumption of small-ruminant products were the ingestion of harmful microbes and toxic chemical substances, such as drug residues, and improper food preparation and preservation. For instance, fermented goat milk products consumed without sufficient processing to kill harmful bacteria, and multidrug-resistant *E. coli* and thermophilic *Campylobacter* spp. present in goat faeces, could be introduced to the milk as a result of poor hygienic practices in milking (Dulo et al. 2015; Hailemariam et al. 2015; Szonyi et al. 2015).

Vaccine development

Vaccines play a crucial role in controlling these diseases. In support of the global eradication program for PPR launched by the World Organisation for Animal Health and the Food and Agriculture Organization of the United Nations, program scientists and international partners backstopped partners in Mali and Botswana to produce test batches of the thermostabilized PPR vaccine using a protocol developed by ILRI scientists. These batches will soon be ready for laboratory and field validation. This product is expected to significantly facilitate the delivery the PPR vaccines in regions where maintaining a cold chain is particularly challenging. Moreover, scientists were involved in the testing of a novel DIVA (differentiating infected from vaccinated animals) vaccine for PPR. As the name suggests, it would allow for the differentiation of vaccinated and non-vaccinated animals, an important tool for use in the later stages of the global PPR eradication program (Holzer et al. 2016).

Significant progress has also been made in developing tools to assist control of CCPP. Scientists initiated the development of a live attenuated vaccine, beginning with the establishment of a robust experimental system (challenge model) with 100% morbidity and 60% mortality (manuscript in preparation). Based on the sequencing of a new isolated ILRI181 strain

¹ However, Dewé et al. 2014 found that women had strong perceptions of quality standards of meat.

(Falquet et al. 2014), a rapid, specific and sensitive assay employing isothermal DNA amplification using recombinase polymerase amplification for the detection of Mccp was developed (Liljander et al. 2015). The assay produces a fluorescent signal within 15–20 minutes and has worked well using pleural fluid obtained directly from CCPP-positive animals without prior DNA extraction. With a short sample preparation time and simple read-out device that can be powered by a car battery, scientists believe CCPP diagnosis can be undertaken in less than 45 minutes. The possibility of applying on-site direct diagnosis of CCPP, combined with a vaccine, will facilitate the early response of veterinary services to contain disease spread.

R4D as a way forward

For most of the disease constraints identified, control tools are already available; however, awareness of these tools and access to the necessary inputs is limited. Adopting a research-for-development approach facilitates delivery of training for communities on the prevention and control of major identified diseases and on mainstreaming gender into project planning and implementation. A number of training workshops have already been organized for farmers on the use of animal health technology packages, such as vaccination and strategic deworming, and the results are encouraging. For instance, following the provision of [training on coenurosis transmission, control measures were successfully piloted](#) by involving communities in dog deworming programs.

A series of cohort studies has been initiated and will continue as part of the CGIAR Research Program on Livestock to evaluate the impact of the interventions. For instance, in collaboration with farmers, community-based animal health workers, local veterinarians and researchers, a cohort study is examining the impact of reproductive diseases and different potential pathogens in several sites where abortions are common. Moreover, longitudinal studies have started to identify the specific etiology of respiratory diseases causing morbidity and mortality of small ruminants in the study sites, and the development of a gender-responsive herd health package to minimize impact of respiratory disease in small ruminants is underway.

Conclusions

The emphasis of this work on assessment has facilitated comparison among a number of tools. While involving a range of stakeholders and putting disease problems into a value chain perspective is useful, from a health perspective, the rapid assessment was insufficient to reliably identify best-bet interventions. The literature reviews gave a useful overview and helped identify research gaps, but not to explain site-specific challenges, particularly as the available data was mostly out-of-date, probably due to changes in disease distribution. While more costly, the in-depth studies provided more reliable entry points to target interventions which led to the establishment of a strong evidence-based health portfolio in Ethiopia. This will help improve collaboration between laboratory and field activities, ensuring useful technologies are tested and further tailored to meet the needs of rural communities. In addition, better synchronization of research efforts between the field and the laboratory scientists will help ensure that the findings of both are better utilized to benefit farmers like Alemtsehay Zenebe.

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