RESEARCH PROGRAM ON Livestock and Fish

CGIAR

*More meat, milk and fish by and for the poor*

# Participatory epidemiology and gender analysis to address small ruminant disease constraints in Livestock and Fish and Africa RISING project sites in Ethiopia

Barbara Wieland, Biruk Alemu, Hiwot Desta, Wole Kinati (ICARDA) and Annet A. Mulema

www.livestockfish.cgiar.org

July 2016

Africa RISING

ICARDA Science for Better Livelihoods in Dry Areas

WorldFish

ILRI INTERNATIONAL LIVESTOCK RESEARCH INSTITUTE

CIAT International Center for Tropical Agriculture Since 1967 / Science to cultivate change

SLU

CGIAR is a global partnership that unites organizations engaged in research for a food-secure future. The CGIAR Research Program on Livestock and Fish aims to increase the productivity of small-scale livestock and fish systems in sustainable ways, making meat, milk and fish more available and affordable across the developing world. The Program brings together five partners: the International Livestock Research Institute (ILRI) with a mandate on livestock; WorldFish with a mandate on aquaculture; the International Center for Tropical Agriculture (CIAT), which works on forages; the International Center for Research in the Dry Areas (ICARDA), which works on small ruminants; and the Swedish University of Agricultural Sciences (SLU) which provides expertise particularly in animal health and genetics. http://livestockfish.cgiar.org

The Program thanks all donors and organizations who globally supported its work through their contributions to the CGIAR system



This report is a product of the International Fund for Agricultural Development (IFAD)-funded SmaRT Ethiopia Project - Improving the Performance of Pro-Poor Sheep and Goat Value Chains for Enhanced Livelihoods, Food and Nutrition Security in Ethiopia

*Patron: Professor Peter C Doherty AC, FAA, FRS*
*Animal scientist, Nobel Prize Laureate for Physiology or Medicine–1996*

Box 30709, Nairobi 00100 Kenya
Phone +254 20 422 3000
Fax +254 20 422 3001
Email ilri-kenya@cgiar.org

ilri.org
*better lives through livestock*

ILRI is a member of the CGIAR Consortium

Box 5689, Addis Ababa, Ethiopia
Phone +251 11 617 2000
Fax +251 11 667 6923
Email ilri-ethiopia@cgiar.org

*ILRI has offices in East Africa • South Asia • Southeast and East Asia • Southern Africa • West Africa*

# Contents

Summary ..... 1
Introduction ..... 1
Materials and methods ..... 2
Study areas ..... 2
Methodology ..... 2
Data analysis ..... 3
Results and discussion ..... 4
Important livestock species and their roles for livelihoods ..... 4
Priority diseases ..... 5
Gender perspective for ranking priority disease category ..... 15
Age group of animals affected ..... 19
Seasonal incidence of disease ..... 19
Impact of small ruminant diseases on households ..... 24
Knowledge of the farmers about transmission of diseases and transmission pathways ..... 28
Involvement of different household members in disease transmission pathways ..... 29
Conclusions ..... 32
References ..... 33
Annex 1 Important livestock species and priority disease list per project site ..... 34

# Summary

Animal diseases continue to constrain livestock productivity, agricultural development, human well-being and poverty alleviation in many regions of the developing world. In Ethiopia this is not only true for Livestock and Fish and Africa RISING project sites, but has been mentioned in sites of different project or programs where ILRI has been involved.

This participatory epidemiology and gender survey was conducted to better understand what these main livestock disease constraints are, how they affect different household, and how much men and women farmers know about their transmission. The findings of the study will also assist in defining future research related to small ruminant diseases, their economic impacts and gender issues related with animal diseases. Moreover, it also established gendered baseline data to monitor impact of future animal health interventions in small ruminants.

The study sites were target areas for Livestock and Fish CRP and the Africa RISING project in the Amhara, Oromia, SNNP and Tigray regions of Ethiopia. A total of 14 Woredas were included in this study. The participatory appraisal methods used in the study included focus group discussions which were conducted with men or women only groups. Various tools, such as semi-structured interview, simple scoring, proportional piling and seasonal calendar were used to facilitate the process. The validity of the results was assured by triangulation (Catley, 2005).

The livestock species important for the communities were identified by investigating the role of each species from economic and social perspectives, rather than asking the usual question which species predominate in the farming system. The top five diseases that affect particularly small ruminants were identified and scored, and during analysis grouped in to seven major disease categories based on clinical signs reported. The animal age and sex group affected and the seasonality of each disease category were also studied.

The impacts of these diseases on household members, men, women, young men and young women, and children were discussed and scored. In addition, discussions revealed that often farmers have tried to identify possible transmission pathways for the major diseases and showed their interest and desire to better understand epidemiology of the diseases. Important differences in roles in animal health management related activities were observed and most importantly, women weighted their input higher than men did. Understanding of who does what within a household opens important entry points to target future interventions related to disease control.

# Introduction

Small ruminants serve multiple livelihood roles including; food sources, income and providing raw material for industries. They are also serve various important cultural purposes. In some communities women have greater control of small ruminants but this is not universal. The increase in demand for small ruminant meat products both locally and international also presents an opportunity for small ruminant keepers to access better markets. However, this potential is not realized because of underperformance of the value chain attributed in-part, to the inability of producers to supply safe products in the required amounts.

The impacts of animal diseases at the household level are well articulated. What is not clear is whether these impacts are gendered. Given that women and men carry out different roles in the management of small ruminants, one would expect that they would be impacted differently in terms of markets, human health and livelihoods given the diversity in use of small ruminants and the complexity of the value chains. However, to a large extent the issue of gendered impact, particularly with regard to animal health and risk mitigation strategies remains unanswered. Part of the reason is that Ethiopia in general suffers from a lack of good, comprehensive, gender-disaggregated data which could provide a baseline against which progress could be measured (Cathy *et al*, 2010).

Veterinarians began using participatory methods in the 1980s, particularly in community-based livestock projects in Africa and Asia. By the late 1990s there was increasing use of the methods and the term 'participatory epidemiology' (PE) became more commonly used to describe veterinary applications of participatory rural appraisal (PRA)-type approaches and methods. However, whereas PRA was a multidisciplinary approach to various development problems in rural communities, PE evolved with a focus on livestock diseases (Catley et al., 2011).

Infectious diseases have a huge impact on productivity in smallholder livestock systems and repeatedly come up as major constraints in household surveys in Ethiopia (Peter, 2013). A participatory epidemiology (PE) and gender survey was conducted to better understand what these main livestock disease constraints are, how they affect different members of households, and how much men and women farmers know about their transmission. This survey is piloted by veterinarians and researchers at the national agricultural research institutes together with ILRI and ICARDA staff in four regions of Ethiopia in the Livestock and Fish CRP program sites and with sites of the Africa RISING project.

The findings of this survey informed the design of a follow-up epidemiological sero-survey and household survey by focusing on key small ruminant diseases commonly mentioned during FGD and of national importance and to better understand site-specific constraints in order to identify and conduct appropriate site-specific interventions which potentially can be scaled out.

The study will also assist in defining future research related to small ruminant diseases, their economic impacts and gender issues related with animal diseases. Moreover, it helps to establish a gendered baseline data to monitor impact of future interventions in small ruminant health.

# Materials and methods

## Study areas

The 23 study sites included in the study are target areas for Livestock and Fish CRP and the Africa RISING project in Amhara, Oromia, SNNP and Tigray regions of Ethiopia. Of the sites are distributed across 14 woredas: five woredas (Basona Worena, Menz Gera, Menz mama, Abergelle and Ziquala) in the Amhara region, three Woredas (Sinana, Yaballo and Horro) in the Oromia region, three woredas from SNNP (Lemo, Doyogena and Menjiwo/Adiyo) and three woredas in the Tigray region (Endemehoni, Atsbi wonberta and Tanqua Abergelle).

## Methodology

A series of preparatory activities were undertaken before the field work. In a training-workshop for veterinarians and researchers from national agricultural research institutes were introduced to participatory epidemiology and the concept of gender analysis, learnt about PE tools and contributed to develop the study protocol and plan the field work.

Four PE and G research team each consisting of 4-5 researchers were established to conduct the survey in Amhara, Tigray, Oromia and SNNP regions of the country. Each team run the PE and G study in respective regions of the country.

A preliminary meeting held with local administration officials and site coordinators to introduce and explain the objectives of the study emphasizing the relevance of disease constraints in small ruminants and their impact on household members. Local site coordinators with local knowledge facilitated contacts with development agents and farmers. Each team comprised a facilitator and note taker responsible for recording of information. As part of the preparation, suitable locations were identified for the FGDs. In each site, separate FGDs were conducted for men, women, male youth and female youth. Therefore in each village 4 FGDs took place. Each FGD had 6-8 participants who were actively involved in small ruminant production and had their own small ruminant herd. Attempts were made to ensure that the men FGDs comprised at least 1-2 local elders and a traditional healer.

The FGDs for men and women were held in parallel and findings of each were briefly presented in a joint session at the end of the FGDs. Similarly, the FGD for young male and young female were held in parallel and their findings shared at the end during feedback sessions. After the FGDs, key informants (para vets/CAHWs) were interviewed for triangulation purposes and to collect additional information or to clarify issues that may have come up during FGDs.

During FGDs various participatory tools were used, including simple ranking, proportional piling and seasonal calendar. First participants discussed importance of different livestock species and allocated 100 counters across the species mentioned to indicate their relative importance. Reasons for scoring the different species were recorded. In the second part, the participants listed five important small ruminant diseases that affect their herds and described the clinical signs of these diseases, in addition local disease names were noted. Then they distributed 100 counters to indicate the relative importance of these diseases. They were asked to explain the reason for putting the scores to assess the importance of each diseases. The participants were also asked to list for the main season categorization in their area and conduct proportional piling of the 'importance counters' of each disease across the identified seasons. And they also conducted proportional piling of the 'importance counters' of each disease across four age and sex categories of animals to assess which group of animals are affected by a disease.

The third part of the FGD looked at the impact of these diseases on different household members. After listing impacts, the participants were asked to distribute twenty counters according to which

household members (men, women, young men, young women, and children) are affected and describe the reason for allocating the counters for the specific household members. They were also asked to mention the coping strategy for the five major small ruminant disease encountered.

The last part of the FGD focused on disease transmission. Participants were asked to explain and list up to five possible disease transmission pathways for the top two diseases. Proportional piling was done by using 20 counters per transmission pathway/situation to find out who (men, women, young men, young women, children) is mainly involved in specific transmission situations.

## Data analysis

The data collected were entered into Epi info software version 7 and exported in to a Microsoft Excel 2013 spreadsheet and analyzed using SPSS version 23. The level of agreement among the scores of informant groups (men, women, young men, young women) was assessed using Kendall's coefficient of concordance (W) (Siegel and Castellan 1994). Consequently, evidence of agreement between informant groups was categorized as ‘weak’, ‘moderate’ and ‘strong’ according to published guidelines on the interpretation of W and the P values assigned; agreement was termed ‘weak’ for $W < 0.26$, $P > 0.05$; ‘moderate’ for $W = 0.26$ to $0.38$, $P < 0.05$ and ‘strong’ for $W > 0.38$, $P < 0.01$.

# Results and discussion

## Important livestock species and their roles for livelihoods

Based on the response of 92 informant groups, sheep had the highest median score with 26/100, followed by cattle with score of 25/100 (Fig. 1). Women, young females and young males scored sheep highest, whereas adult men strongly agreed to give priority to cattle (W= 0.551, p=0.000) (Fig. 2 and Table 1).

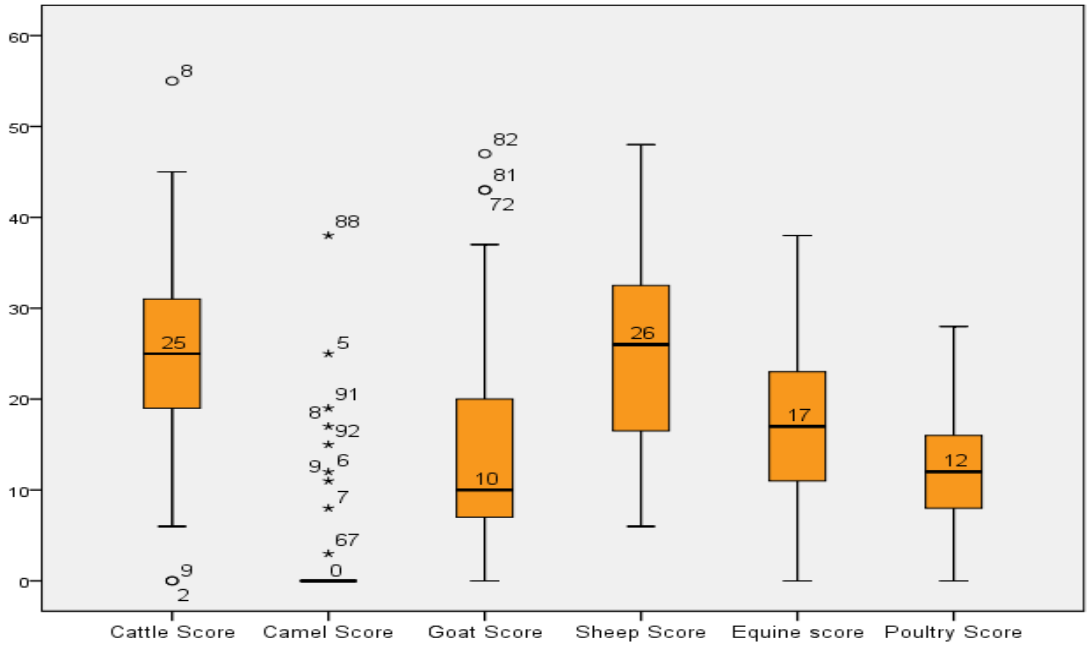


**Figure 1:** Score out of hundred counters given for important livestock species

Non-surprisingly, in the communities included, small ruminants play a significant role for the livelihood. Farmers mentioned the comparative advantage of small ruminants like immediate source of income, fast reproduction rate, low feed consumption, and source of meat for household consumption, for example in the case of social festivities. They made strong statements like “sheep are like fast growing cabbage in the homestead” and “Sheep are like ‘Injera’ ready to be eaten”. Small ruminants are also considered as docile and can easily be managed by women and children.

Even though the study focused on areas where small ruminant production is common, the role of cattle was still hugely important. The main reasons to mention cattle as important livestock were: use for ploughing and threshing crops, source of incomes from milk and milk products, incomes from fattening, social value during traditional festivity/social status indicators, considered as live banks/saving instrument for farmers, manure for fuel and fertilizer, the hides used as bed sheet. Especially women and youth female mentioned cattle as source of income, particularly in Oromia and SNNP regions.

Camel was mentioned as important livestock species by all gender groups only in Oromia region, Yabello district. Reasons given for ranking camel as an important livestock species include milk production and meat for household consumption, pack animal, source of cash income and drought resistant.

All gender groups mentioned the use of equine as pack animal, pulling of cart, ploughing and compacting of land and threshing of crops as the major reason of considering them as important livestock species in all regions. Cash income either through selling or renting was also mentioned in

Oromia and SNNPR regions. The use of horses for social and traditional ceremonies including horse riding is common as described by all gender groups in Oromia region.

Chicken were mentioned in all FGDs, with the explanation that they can quickly be turned into cash and are low maintenance.

Interestingly in FGDs conducted in Amhara regions, pets were mentioned by all gender groups with the explanation that dogs are needed for herding of small ruminants and protecting them at night and that cats are used for pest control and prevent rats from eating feeds.

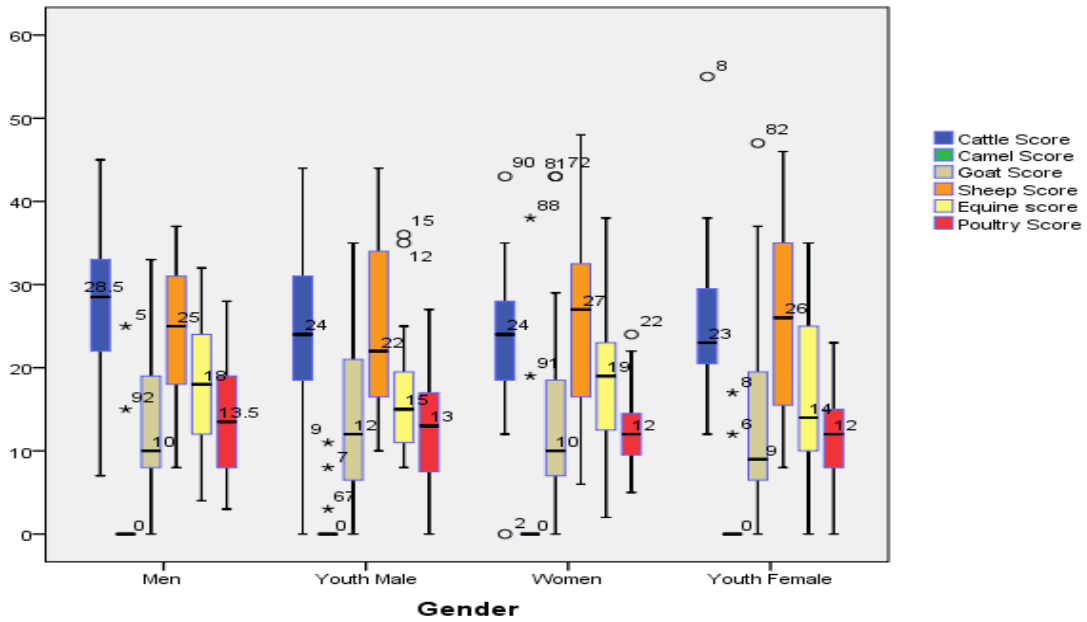


**Figure 2:** Score for importance of livestock species from gender perspective

**Table 1:** Level of agreement within respondent groups for important livestock species

| Gender | N | Mean rank score | | | | | | Kendall's W[a] | Chi-Square | Df | Asymp. Sig. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Cattle | Goat | Sheep | Equine | Camel | Poultry | | | | |
| Men | 23 | 5.11 | 3.14 | 4.82 | 3.68 | 1.32 | 2.93 | 0.551 | 60.59 | 5 | 0.000 |
| Young male | 23 | 4.65 | 3.41 | 4.93 | 3.70 | 1.22 | 3.09 | 0.507 | 58.35 | 5 | 0.000 |
| Women | 23 | 4.72 | 3.09 | 4.83 | 3.89 | 1.41 | 3.07 | 0.467 | 53.75 | 5 | 0.000 |
| Young female | 23 | 4.8 | 3.17 | 4.89 | 3.8 | 1.39 | 2.93 | 0.498 | 57.24 | 5 | 0.000 |

a. Kendall's Coefficient of Concordance

## Priority diseases

Although the clinical signs described for most of the diseases raised by farmers are consistent with clinical signs and indicators described in veterinary literature and textbooks (Merck 2010; Radostits et al. 2006), a conclusive diagnosis based on clinical signs is difficult and without laboratory confirmation unscientific. Thus, based on the farmers' description of clinical signs, small ruminant diseases were grouped in to seven main categories.

According to informants, the clinical signs and indicators of diseases under each category were described in Table 2.

Based on proportional piling (out of 100 counters), the median score for the respiratory disease category was highest in all regions with 24.5 in Amhara, 23 in Oromia, 28 in SNNP and 30 in Tigray region. This indicates that respiratory diseases are a priority problems in all studied regions. The median score for other disease categories varies from region to region. For example the median score for neurological disease is around 25 in Oromia, 6 in Amhara and zero for Tigray and SNNP (Fig. 3).

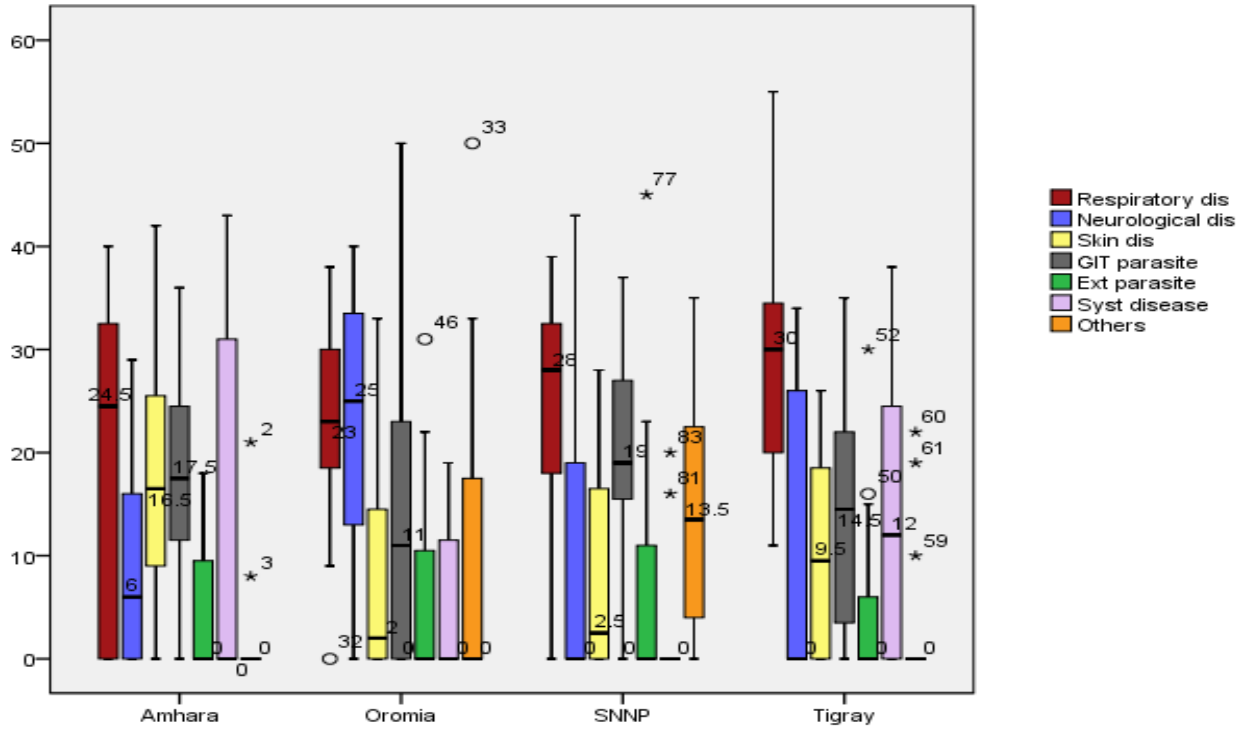


**Figure 3:** The median score given by FGD for each disease categories in each region.

**Table 2:** Disease categorization, description, possible differential diagnoses and local names of disease.

| Major Disease Categories | Description | Local names of diseases included in each categories (a/b)* | Diseases listed by vet/paravets/CAHWs |
|---|---|---|---|
| 1. Respiratory disease | • Diseases which are related to the respiratory system: common clinical signs like coughing, sneezing, nasal discharge, dyspnea, abnormal respiratory sounds and different lung lesions at slaughter. | • Amhara<br>- Engib/Wotewut/Pasteurollosis (15/27)<br>- Sale/coughing (11/27)<br>- Mech/pneumonia (1/27)<br>• Oromia<br>- Sombeessa/Bubbutaa caccabsaa /Argansoo /CCPP (12/30)<br>- Qufaa/Pneumonia (4/30)<br>- Furroo/Surridoo/Pasteurollosis (12/30)<br>- Sillisa (1/30)<br>- Hudhaa/Kokke (1/30)<br>• SNNP<br>- Ganshua/Oshiyo/pasteurollosis (16/23)<br>- Qedefera (4/23)<br>- Qelli nafo (2/23)<br>- Koyooo (1/23)<br>• Tigray<br>- Halkafean/Tegta/Mieta/Pasteurellosis (19/29)<br>- Samba/pneumonia (10/29) | • Pasteurollosis<br>• Pneumonia<br>• Coughing<br>• CCPP |
| 2. Neurological disease | • Diseases which affect the CNS: signs of circling, convulsion, staggering, abnormal behavior, abnormal gait and ataxia | • Amhara<br>- Baria wez/Azurit/Tinan/coenuruses (13/13)<br>• Oromia<br>- Sirgoo/Lafan Martoo/coenurosis (22/25)<br>- Riqannoota (2/25)<br>- Fuun Duuda (1/25)<br>• SNNP<br>- Boko hucha/Qele Gudo/coenurosis (9/9)<br>• Tigray<br>- Zarti/Hsake Resi/kenin/Azar/Aqnine/coenurosis (9/10)<br>- Gurgurit/Haseka Riesi/Ostrus ovis (1/10) | • Coenuruses<br>• Ostrous ovis |
| 3. Skin disease | • Diseases which affect skin: | • Amhara | • Sheep and goat pox |

| | | | |
|---|---|---|---|
| | different skin lesions and signs like hair loss, crusts, scabs, irritation, itching. | - Fentata/Sheep and goat pox (21/21)<br>• Oromia<br>- Abdarraa/Dorrobboo/Umburura/orf (8/11)<br>- Finnoo/Darrabo/Sheep and goat pox (3/11)<br>• SNNP<br>- Kurkursa/orf (9/11)<br>- Gogimos/Qodi Mosu (2/11)<br>• Tigray<br>- Shihure/Bededo/Shilimat/Enfrir/Sheep and goat pox (8/11)<br>- Af'tetem/Afe'mear/orf (3/11) | • orf |
| 4. GIT parasite | • Diseases that causes clinical signs of diarrhea, emaciation, erected hair, ascites, bottle jaw, and presence of different stages of parasite in feces and in GIT at slaugther. | • Amhara<br>- Mawule/Liver fluke (12/27)<br>- Tekemate/Diarrhea (15/27)<br>• Oromia<br>- Dodo'o/malullaa/Jiitoo/Liver fluke (11/16)<br>- Albaasaa /Diarrhea (3/16)<br>- Albaatii (2/16)<br>• SNNP<br>- Macho achi cheno/Mecho Nefo (6/33)<br>- Zeaso /Adora/Diarrhea (17/33)<br>- Lomme'eta/wochiwocha/bottle jaw (9/33)<br>- Hamasu/temu (1/33)<br>• Tigray<br>- Himam sunba/lung worm (5/20)<br>- Efeel/Haseka Kebdi/Liver fluke (7/20)<br>- Tsihtsah/Gurgurit/ GIT parasite/Haemonchosis (8/20) | • Liver fluke<br>• Haemonchosis<br>• Lung worm |
| 5. External parasite | • External parasites resulting in alopecia, itching, irritation, disturbance while grazing, visible to naked eye, externally on the skin of animals (tick, lice, sheep ked) | • Amhara<br>- Ekek/mange mite (6/9)<br>- Yewuchi Tegegna/Tick, sheep ked and lice (3/9)<br>• Oromia<br>- Cittoo/Mange mite (9/9)<br>• SNNP<br>- Aliqaru/Bacharuta/Benqera/Tick, lice, sheep ked (8/8)<br>• Tigray<br>- Kurdid/Tick/sheep ked (3/8)<br>- Abeq/Mange mite (5/8) | • Tick, Lice, Sheep ked, Mange mite |

| | | | |
|---|---|---|---|
| 6. Systemic disease | • Multi-systemic diseases with a range of clinical signs | • Amhara<br>- Enetit/anthrax (9/19)<br>- Sheleme/PPR (8/19)<br>- Dira/Blackleg (2/19)<br>• Oromia<br>- Marra-Reeba (3/17)<br>- Qandhoo/General septicemia (6/17)<br>- Dhukkuba Tiruu/Necrotic hepatitis (8/17)<br>• SNNP<br>- Kankanto/Anthrax (3/3)<br>• Tigray<br>- Hamot kebdi/Tafia/Megerem/Anthrax (11/16)<br>- Werchi/Blackleg (1/16)<br>- Tsehtsah/weqie/PPR (4/16) | • PPR<br>• Anthrax<br>• Black leg<br>• FMD |
| 7. Others | • Those diseases with unknown cause, non-infectious, metabolic in nature and difficult to be classified in the above listed categories. | • Amhara<br>- Unknown Dingetegna Besheta (2/2)<br>• Oromia<br>- Dhibe hin beekamne(Unknown disease) (5/12)<br>- Raammoo miilaa (1/12)<br>- Maasaa/Barga'oo/Ho'ichoo/Foot rot (6/12)<br>• SNNP<br>- Micho (1/22)<br>- Elemoosu/Elitiso/Eye disease (6/22)<br>- Bloating (3//22)<br>- Nutero/Loka Hucha/Yebeg moyele/Naqarisa/Foot rot (11/22)<br>- Senbecha/chinyako (1/22)<br>• Tigray<br>- Mbray/Abortion (1/2)<br>- Himam tub/mastitis (1/2) | • Eye disease<br>• Foot rot<br>• Bloating<br>• Abortion<br>• Mastitis |

*(No. of times the local name of the disease is mentioned/No of times the category is mentioned)

**Table 3:** The mean and other descriptive statistics for disease categories in each regions.

| Region | Descriptive Statistics | Res Dis | Neur Dis | Skin Dis | GIT par | Ext Par | Syst Dis | Other |
|---|---|---|---|---|---|---|---|---|
| Amhara | N | 24 | 24 | 24 | 24 | 24 | 24 | 24 |
| | Mean | 20.21 | 8.12 | 17.37 | 18.62 | 4.54 | 12.54 | 1.21 |
| | Std. Deviation | 15.427 | 8.887 | 11.609 | 8.914 | 6.311 | 16.811 | 4.52 |
| | Minimum | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Maximum | 40 | 29 | 42 | 36 | 18 | 43 | 21 |
| Oromia | N | 24 | 24 | 24 | 24 | 24 | 24 | 24 |
| | Mean | 22.54 | 22.71 | 7.42 | 13.38 | 5.08 | 5 | 10.33 |
| | Std. Deviation | 8.792 | 13.02 | 9.659 | 14.135 | 8.905 | 7.04 | 14.202 |
| | Minimum | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Maximum | 38 | 40 | 33 | 50 | 31 | 19 | 50 |
| SNNP | N | 24 | 24 | 24 | 24 | 24 | 24 | 24 |
| | Mean | 24.96 | 9.67 | 8.25 | 20.83 | 6.29 | 1.5 | 13.54 |
| | Std. Deviation | 10.063 | 14.346 | 9.918 | 8.909 | 11.312 | 5.116 | 10.405 |
| | Minimum | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Maximum | 39 | 43 | 28 | 37 | 45 | 20 | 35 |
| Tigray | N | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| | Mean | 29.2 | 10.65 | 10.05 | 14.45 | 4.35 | 13.7 | 2.55 |
| | Std. Deviation | 12.142 | 13.593 | 9.682 | 11.171 | 7.889 | 12.097 | 6.549 |
| | Minimum | 11 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Maximum | 55 | 34 | 26 | 35 | 30 | 38 | 22 |

In Amhara region, GIT parasite, skin disease and respiratory disease category were ranked first, second and third respectively. There was a moderate agreement (W = 0.33, P = 0.000) between the informant groups to rank the priority disease category (Table 4).

There were important differences when disaggregating data based on the agro-ecology of the woredas. The respiratory disease category was ranked first in the highlands followed by skin diseases with strong agreements among the informant groups (W = 0.68, P = 0.000) and systemic disease followed by GIT parasite were the priority disease categories in the lowlands, also with strong agreement among informant groups (W = 0.73, P = 0.000) (Table 4).

**Table 4:** Top priority disease categories in Amhara region.

| | Overall Woredas | | Highland Woredas | | Lowland Woredas | |
|---|---|---|---|---|---|---|
| DC | Mean rank score | Test statistics | Mean rank score | Test statistics | Mean rank score | Test statistics |
| 1 | 5.06 | N=24 | 6.56 | N=16 | 2.06 | N=8 |
| 2 | 3.65 | Kendall's W= 0.327 | 3.75 | Kendall's W= 0.684 | 3.44 | Kendall's W= 0.737 |
| 3 | 5.15 | Chi-Square= 47.111 | 5.50 | Chi-Square= 65.692 | 4.44 | Chi-Square=35.385 |
| 4 | 5.23 | Df=6 | 4.97 | Df=6 | 5.75 | Df=6 |
| 5 | 2.92 | Asymp. Sig.= 0.000 | 2.63 | Asymp. Sig.= 0.000 | 3.50 | Asymp. Sig.= 0.000 |
| 6 | 3.75 | | 2.25 | | 6.75 | |
| 7 | 2.25 | | 2.34 | | 2.06 | |

DC= Disease Categories 1= Respiratory disease category 2=Neurological disease category 3= Skin disease 4= GIT parasite 5= External parasite 6= Systemic disease 7= Others

In Oromia region, respiratory, neurological and GIT parasite disease categories were ranked first, second and third, respectively. Moderate agreement (W = 0.33, P = 0.00) was observed among the informant groups (Table 5). Considering only lowland woredas, it was neurological disease followed by respiratory and systemic disease category in order of priority with strong agreement among the groups (W= 0.859, p=0.00).

**Table 5:** Top priority disease categories in Oromia region

| | Overall Woredas | | Highland Woredas | | Lowland Woredas | |
|---|---|---|---|---|---|---|
| DC | Mean rank score | Test statistics | Mean rank score | Test statistics | Mean rank score | Test statistics |
| 1 | 5.73 | N=24 | 5.47 | N=16 | 6.25 | N=8 |
| 2 | 5.52 | Kendall's W=0.330 | 4.91 | Kendall's W=0.338 | 6.75 | Kendall's W=0.859 |
| 3 | 3.38 | Chi-Square=47.552 | 3.78 | Chi-Square=32.489 | 2.56 | Chi-Square=41.254 |
| 4 | 4.08 | Df=6 | 4.97 | Df=6 | 2.31 | Df=6 |
| 5 | 2.92 | Asymp. Sig.=0.000 | 3.09 | Asymp. Sig.=0.000 | 2.56 | Asymp. Sig.=0.000 |
| 6 | 2.81 | | 1.97 | | 4.50 | |
| 7 | 3.56 | | 3.81 | | 3.06 | |

In Tigray region, respiratory, GIT parasite and systemic disease categories were ranked first, second and third, respectively. Moderate agreement (W = 0.34, P = 0.000) was observed among the informant groups to rank the priority disease category (Table 6). The result varies when the analysis

was done per agroecology. In lowland areas, the priorities were respiratory, systemic and skin disease categories with strong agreement among the groups (w=0.89, p=0.002).

**Table 6:** Top priority disease categories in Tigray region

| | Overall Woredas | | Highland Woredas | | Lowland Woredas | |
|---|---|---|---|---|---|---|
| DC | Mean rank score | Test statistics | Mean rank score | Test statistics | Mean rank score | Test statistics |
| 1 | 6.18 | N=20 | 6.03 | N=16 | 6.75 | N=4 |
| 2 | 3.68 | Kendall's W=0.338 | 4.13 | Kendall's W=0.382 | 1.88 | Kendall's W=0.890 |
| 3 | 3.83 | | 3.66 | | 4.50 | |
| 4 | 4.48 | Chi-Square=40.550 | 5.13 | Chi-Square=36.718 | 1.88 | Chi-Square=21.355 |
| 5 | 2.95 | Df=6 | 2.69 | Df=6 | 4.00 | Df=6 |
| 6 | 4.43 | Asymp. Sig.=.000 | 3.97 | Asymp. Sig.=.000 | 6.25 | Asymp. Sig.=.002 |
| 7 | 2.48 | | 2.41 | | 2.75 | |

In SNNP region, respiratory, GIT parasite and other disease category were ranked first, second and third, respectively. Strong agreement (W = 0.39, P = 0.000) was observed among the informant groups to rank the priority disease category (Table 7).

**Table 7:** Top priority disease categories in SNNP region

| | Overall Woredas (Highland) | |
|---|---|---|
| DC | Mean rank score | Test statistics |
| 1 | 5.73 | N=24 |
| 2 | 3.46 | Kendall's W=0.389 |
| 3 | 3.58 | Chi-Square=56.052 |
| 4 | 5.60 | Df=6 |
| 5 | 3.08 | Asymp. Sig.=.000 |
| 6 | 2.27 | |
| 7 | 4.27 | |

Figure 4 – 7, shows the number of times that the local names of diseases mentioned by farmers in each category for each region. Table 2 shows the identified diseases in local names in each disease categories and region. Pasteurellosis and coenurosis, in different local names, were mentioned as priority disease in the respiratory and neurological disease category respectively in all regions. Sheep and goat pox is stated to be the major disease in the skin disease category in Amhara and Tigray whereas orf was the most common disaesae in Oromia and SNNP. Liver fluke is the major disease mentioned in the GIT parasite category in all regions. In the external parasite category, mange mite was the most important in all regions except in SNNP where tick, lice and sheep ked were mentioned. Anthrax and PPR were mentioned as major diseases in Amhara and Tigray lowland woredas. Foot rot and eye disease are stated to be the major ones in Oromia and SNNP in others disease category.

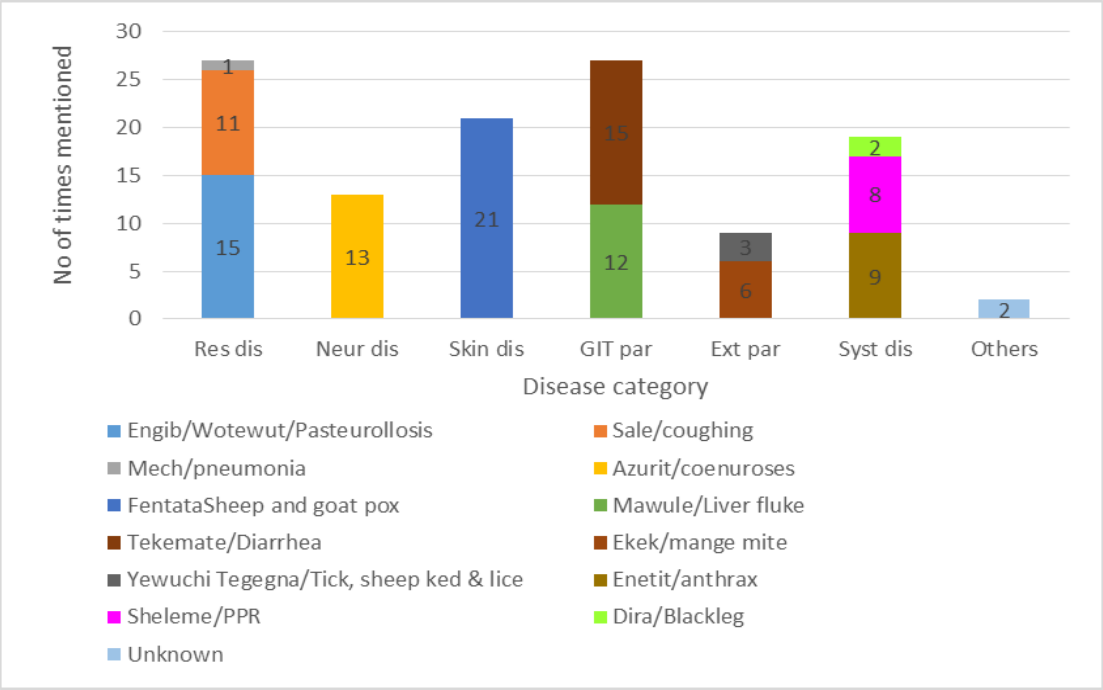


**Figure 4:** Local name of diseases mentioned in Amhara region

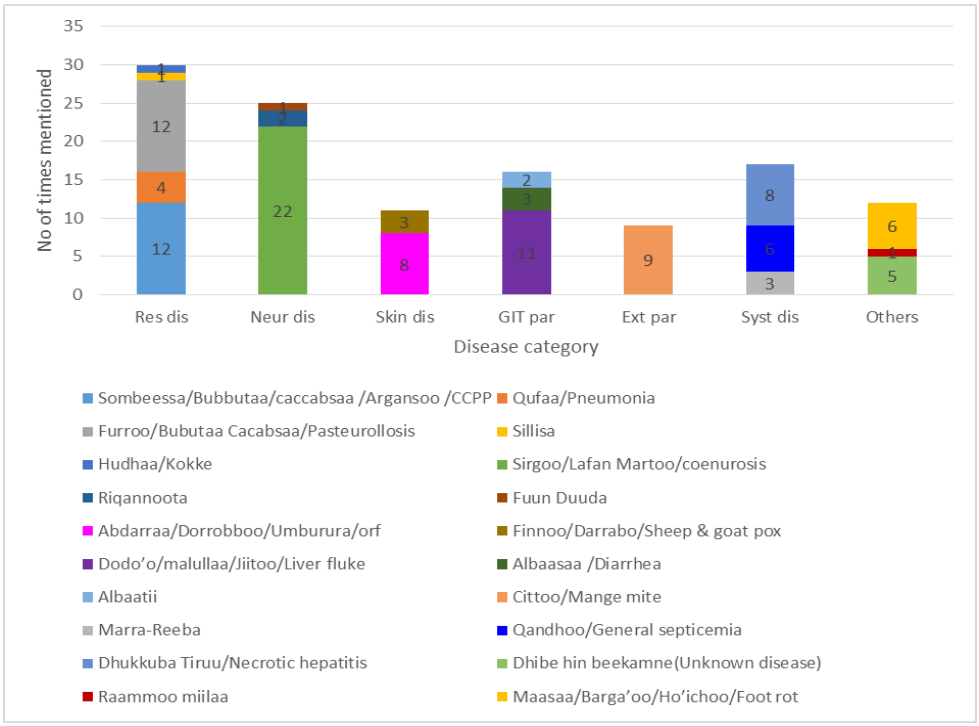


**Figure 5:** Local name of diseases mentioned in Oromia region

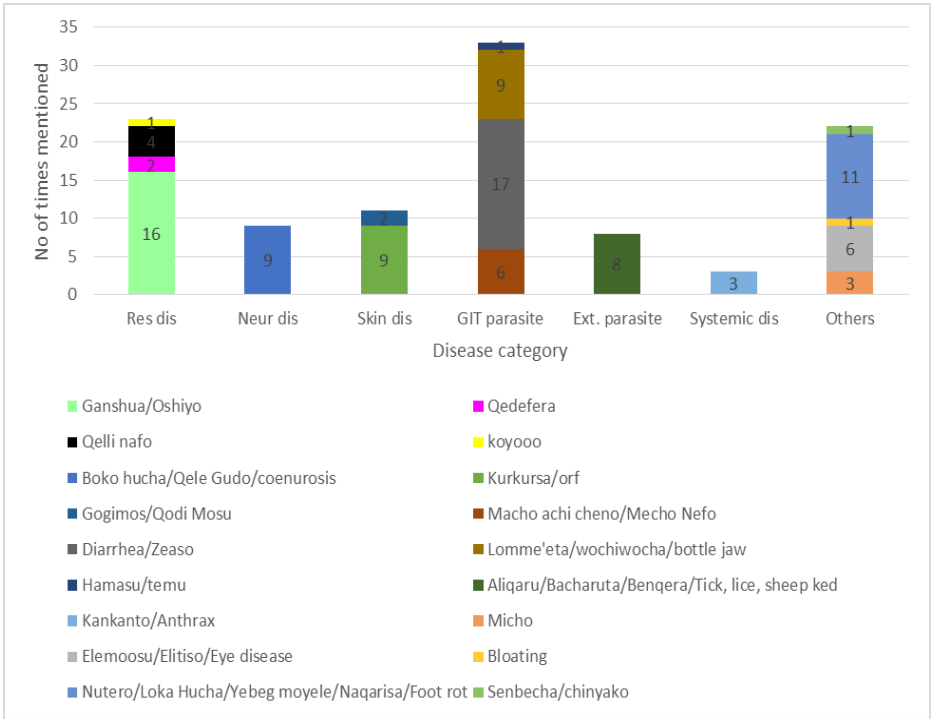


**Figure 6:** Local name of diseases mentioned in each disease category in SNNP region

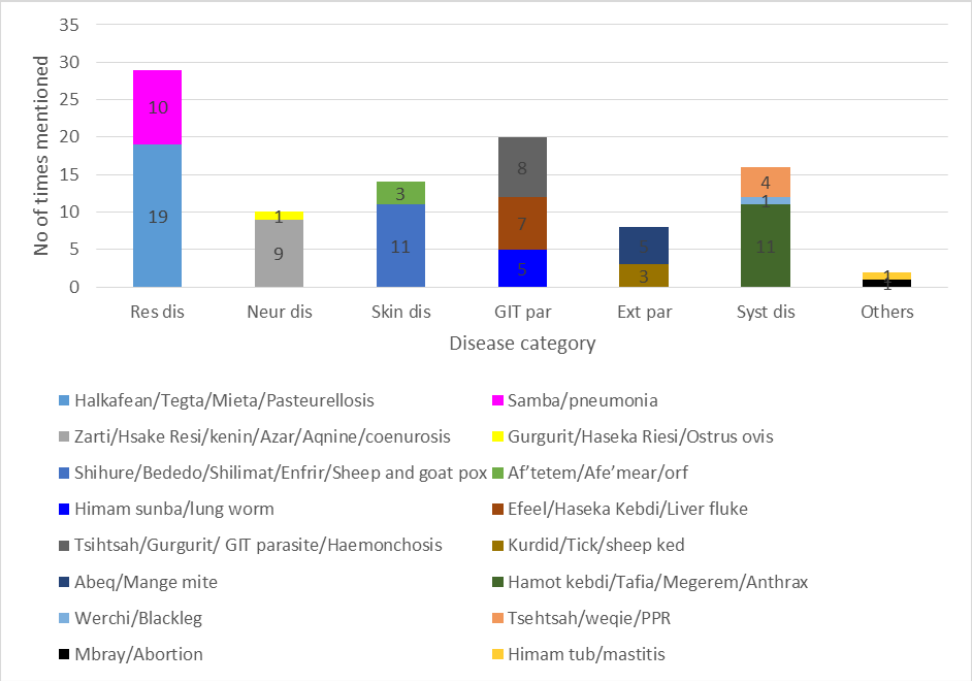


**Figure 7:** Local name of diseases mentioned in Tigray region

## Gender perspective for ranking priority disease category

Catley et al. (2011) indicated gender analysis tools that can be tailored to animal health activities include: Livestock Keeping Household Activity Profiling; Livestock Activity, Access to and Control over Resources Profiling; a Livestock Resources and Benefits Index; and a Practical and Strategic Gender Needs in Livestock Management Index.

In this study we have also seen the ability of women in identifying priority disease constraints of their area given that we facilitate their full participation in discussion without any interference. When looking at gender disaggregated data (men, young male, women and young female) in the four regions, there was no striking significant difference among gender in identifying the priority disease constraints. Women and young female scored respiratory diseases slightly higher than young male and men with 29 and 27, compared to 24 and 23. Young men scored neurological diseases higher than the other respondent groups with a median score of 12 compared to scores of 11, 6 and 0 given by women, men and young female groups respectively (Fig. 8).

Coenuruses was frequently mentioned as suspected small ruminant disease in the neurological disease category. This disease is stated to have impact for herders since the diseased animals need special attention during herding. This could explain the higher median score assigned by young male since they are more involved in herding than other household members.

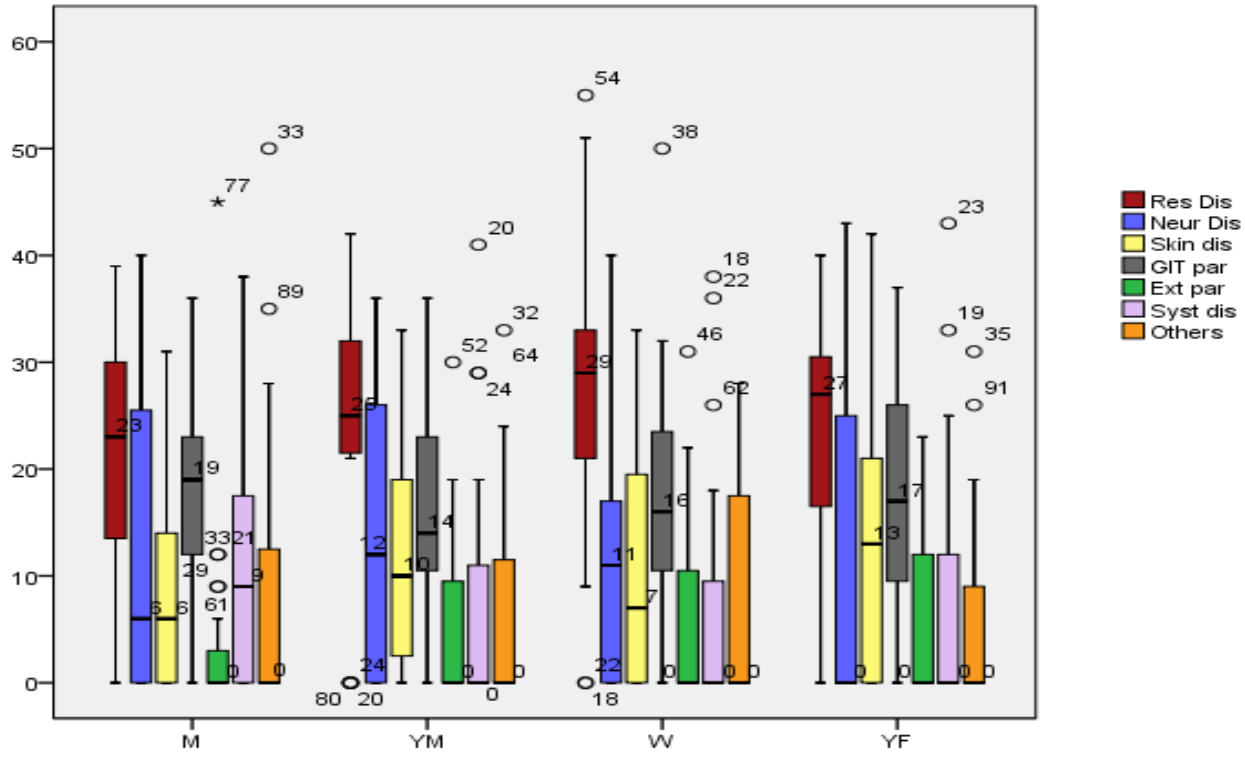


**Figure 8:** The median score given by each gender for each disease categories

**Table 8:** The mean and other descriptive statistics for different disease categories by gender.

| Gender | | Res dis | Neur dis | Skin dis | GIT par | Ext par | Syst dis | Others |
|---|---|---|---|---|---|---|---|---|
| M | Mean | 22.13 | 12.87 | 8.17 | 17.57 | 4.04 | 11.39 | 7.78 |
| | N | 23 | 23 | 23 | 23 | 23 | 23 | 23 |
| | Std. Deviation | 11.530 | 14.319 | 9.039 | 11.421 | 9.851 | 12.623 | 14.003 |
| W | Mean | 26.61 | 11.70 | 10.65 | 17.26 | 5.65 | 6.83 | 8.39 |
| | N | 23 | 23 | 23 | 23 | 23 | 23 | 23 |
| | Std. Deviation | 13.365 | 12.661 | 11.590 | 11.643 | 8.648 | 11.788 | 10.672 |
| YF | Mean | 23.48 | 12.26 | 12.35 | 17.09 | 5.52 | 6.96 | 5.48 |
| | N | 23 | 23 | 23 | 23 | 23 | 23 | 23 |
| | Std. Deviation | 11.188 | 15.659 | 12.594 | 11.843 | 7.982 | 12.364 | 9.110 |
| YM | Mean | 23.83 | 14.70 | 12.04 | 15.78 | 5.17 | 6.61 | 6.74 |
| | N | 23 | 23 | 23 | 23 | 23 | 23 | 23 |
| | Std. Deviation | 12.594 | 12.826 | 10.173 | 10.660 | 8.789 | 11.881 | 9.887 |
| Total | Mean | 24.01 | 12.88 | 10.80 | 16.92 | 5.10 | 7.95 | 7.10 |
| | N | 92 | 92 | 92 | 92 | 92 | 92 | 92 |
| | Std. Deviation | 12.108 | 13.735 | 10.878 | 11.232 | 8.719 | 12.133 | 10.948 |

In Amhara region, the men and young male groups ranked GIT parasite, skin disease and respiratory disease as first, second and third priority disease category. There is a significant strong agreement among this group (w= 0.408, p<0.001). Whereas the women and young female group placed respiratory and skin disease as first priority and GIT parasite as second priority disease category with a significant moderate agreement among the group (w= 0.271, p<0.01) (Table 9).

**Table 9:** Priority disease category by men and young male and women and young female in Amhara region.

| Disease category | Mean rank score by men and young male | Test Statistics | Mean rank score by women and young female | Test Statistics |
|---|---|---|---|---|
| 1. Res dis | 5.00 | N = 12 | 5.13 | N = 12 |
| 2. Neur dis | 4.00 | Kendall's W[a] = 0.408 | 3.29 | Kendall's Wa = 0.271 |
| 3. Skin dis | 5.17 | Chi-Square = 29.362 | 5.13 | Chi-Square = 19.523 |
| 4. GIT par | 5.50 | Df = 6 | 4.96 | Df = 6 |
| 5. Ext par | 2.71 | Asymp. Sig. = 0.000 | 3.13 | Asymp. Sig. = 0.003 |
| 6. Syst dis | 3.71 | | 3.79 | |
| 7. Others | 1.92 | | 2.58 | |

[a]Kendall's Coefficient of Concordance

In Oromia, the men and young male group ranked neurological disease, respiratory disease and GIT parasite as first, second and third priority disease category. There is a significant strong agreement among this group (w= 0.388, p<0.001). Whereas the women and young female group placed respiratory, neurological disease and GIT parasite as first, second and third priority disease category with a significant moderate agreement among the group (w= 0.313, p<0.01) (Table 10).

**Table 10:** Priority disease category by men and young male and women and young female in Oromia region.

| Disease category | Mean rank score by men and young male | Test Statistics | Mean rank score by women and young female | Test Statistics |
|---|---|---|---|---|
| 1. Res dis | 5.79 | N = 12 | 5.67 | N = 12 |
| 2. Neur dis | 5.83 | Kendall's W[a] = 0.388 | 5.21 | Kendall's Wa = 0.313 |
| 3. Skin dis | 3.08 | Chi-Square = 27.970 | 3.67 | Chi-Square = 22.572 |
| 4. GIT par | 3.75 | Df = 6 | 4.42 | Df = 6 |
| 5. Ext par | 2.75 | Asymp. Sig. = 0.000 | 3.08 | Asymp. sig. = 0.001 |
| 6. Syst dis | 3.25 | | 2.38 | |
| 7. Others | 3.54 | | 3.58 | |

a. Kendall's Coefficient of Concordance

In Tigray, the men and young male group ranked respiratory disease, systemic disease and GIT parasite as first, second and third priority disease category. There is a significant strong agreement among this group (w= 0.264, p<0.001). Whereas the women and young female group placed respiratory, GIT parasite and systemic disease as first, second and third priority disease category with a significant moderate agreement among the group (w= 0.438, p<0.01) (Table 11).

**Table 11:** Priority disease category by men and young male and women andyoung female in Tigray region.

| Disease category | | Mean rank score by men and young male | Test Statistics | Mean rank score by women and young female | Test Statistics |
|---|---|---|---|---|---|
| 1. | Res dis | 5.85 | N = 10 | 6.50 | N = 10 |
| 2. | Neur dis | 3.85 | Kendall's Wa = 0.264 | 3.50 | Kendall's Wa = 0.438 |
| 3. | Skin dis | 3.60 | Chi-Square = 15.849 | 4.05 | Chi-Square = 26.253 |
| 4. | GIT par | 4.35 | Df = 6 | 4.60 | Df = 6 |
| 5. | Ext par | 2.95 | Asymp. Sig. = 0.015 | 2.95 | Asymp. Sig. = 0.000 |
| 6. | Syst dis | 4.65 | | 4.20 | |
| 7. | Others | 2.75 | | 2.20 | |

a. Kendall's Coefficient of Concordance

In SNNP, the men and young male group ranked GIT parasite, respiratory disease other disease as first, second and third priority disease category. There is a significant strong agreement among this group (w= 0.408, p<0.001). Whereas the women and young female group placed respiratory, GIT parasite and other disease as first, second and third priority disease category with a significant moderate agreement among the group (w= 0.381, p<0.001) (Table 12).

**Table 12:** Priority disease category by men and young male and women and young female in SNNP region.

| Disease category | | Mean rank score by men and young male | Test Statistics | Mean rank score by women and young female | Test Statistics |
|---|---|---|---|---|---|
| 1. | Res dis | 5.63 | N = 12 | 5.83 | N = 12 |
| 2. | Neur dis | 3.42 | Kendall's Wa = 0.408 | 3.50 | Kendall's Wa = 0.381 |
| 3. | Skin dis | 3.83 | Chi-Square = 29.388 | 3.33 | Chi-Square = 27.413 |
| 4. | GIT par | 5.71 | Df = 6 | 5.50 | Df = 6 |
| 5. | Ext par | 2.88 | Asymp. Sig. = 0.000 | 3.29 | Asymp. Sig. = 0.000 |
| 6. | Syst dis | 2.25 | | 2.29 | |
| 7. | Others | 4.29 | | 4.25 | |

a. Kendall's Coefficient of Concordance

Generally the higher priority given by women and young female for respiratory disease category could be related with the higher chance for women and young female to detect the suffocation in the barn during barn cleaning and close observation of animals in their barn. In Oromia, it is explained that these respiratory diseases could lead to bad smell of the barn and women mostly faced this condition during sanitation.

## Age group of animals affected

FGD respondents were asked to distribute the 'importance counters' of each disease among four age and sex categories of animals (lam/kids, young animals, adult female, adult male) to indicate which animal group is most affected by a disease. Overall adult females were highly affected across disease categories, except for the neurological disease category. There is a significant moderate agreement (w= 0.243, p<0.001) among the groups (Table 13). Overall newborns seemed the least affected group. The young age group was identified as being highly affected by neurological disease c (Fig. 9). Adult females are most of the time breeding animals which can be in the herd for a long time and experience the diseases repeatedly so that farmers may consider them as a highly susceptible group. It is also true that stress factors like pregnancy and lactation could predispose this group for different disease. Also, one particular sex may be regarded by farmers as being of greater value than the other and will therefore receive a correspondingly greater amount of care and attention when sick (Putt et al., 1988).

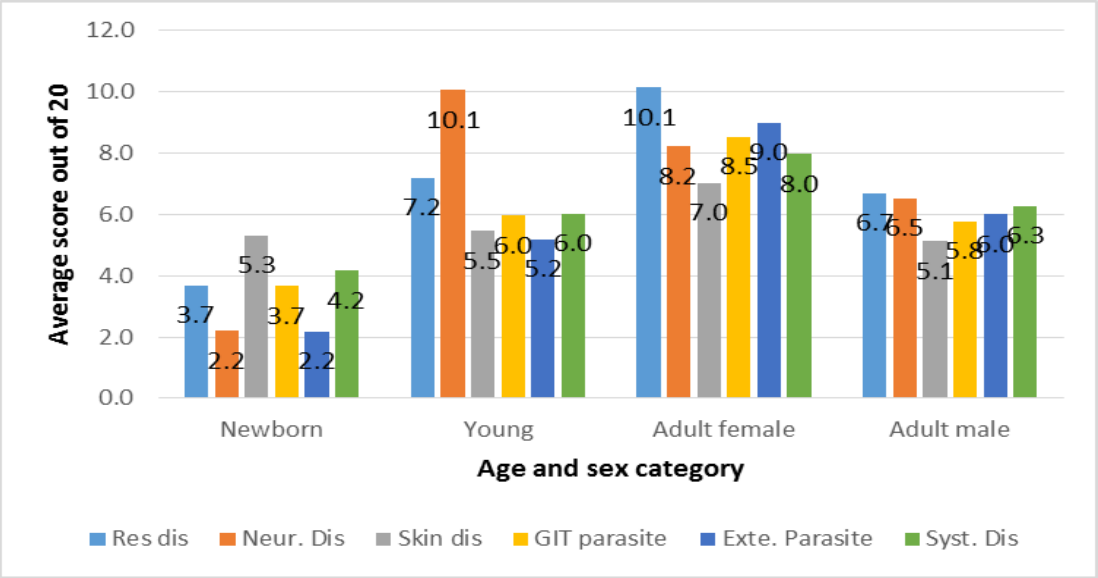


**Figure 9:** Mean score of age group affected by different disease category.

**Table 13:** Agreement among group to rank age group affected by all disease category.

| Age and sex category | Mean rank score | Test Statistics |
|---|---|---|
| Newborn | 1.77 | N = 275 |
| Young | 2.57 | Kendall's W[a] = 0.243 |
| Adult female | 3.25 | Chi-Square = 200.066 |
| Adult male | 2.41 | Df = 3 |
| | | Asymp. Sig. = 0.000 |

a. Kendall's Coefficient of Concordance

## Seasonal incidence of disease

In Amhara region, the respondent groups were able to determine the seasonality of GIT parasite and respiratory diseases. There was a moderate agreement (W=0.357, p<0.05) that GIT parasite mostly occur during Belg season (March to May) with a mean score of 10.82 followed by the rainy season (June to September) and meher season (October to February) with mean scores of 10.45 and 3.55

respectively. Respiratory diseases were reported to mostly occur druing rainy season (w=0.189, p<0.05) with mean score of 14.3 followed by meher and belg seasons with 7.37 and 6.11 mean scores (Fig. 10, Table 14).

This will help to predict the most appropriate time to plan preventive or curative interventions for diseases listed in these categories prevailing in the area.

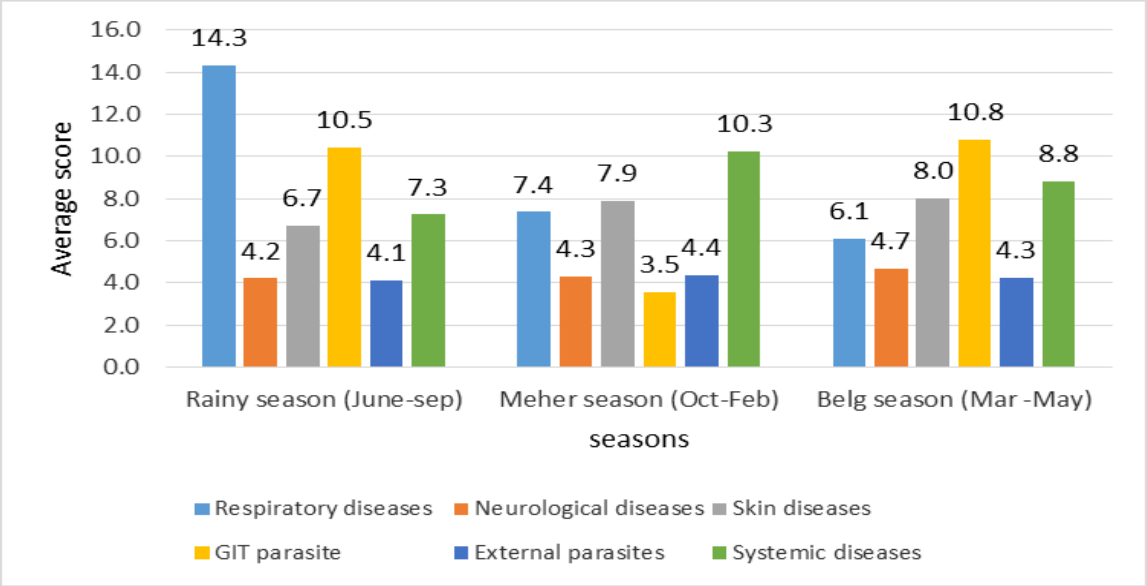


**Figure 10:** Seasonality of diseases based on average score in Amhara region.

**Table 14:** Agreement among FGD in Amhara region to determine seasonality of diseases.

| Disease category | N | Mean rank score | | | Kendall's W[a] | Chi-Square | Df | Asymp. Sig. |
|---|---|---|---|---|---|---|---|---|
| | | Rainy season | Meher season | Belg season | | | | |
| Respiratory dis | 19 | 2.47 | 1.84 | 1.68 | 0.189 | 7.2 | 2 | 0.027 |
| Neurological dis | 9 | 1.83 | 2.06 | 2.11 | 0.041 | 0.737 | 2 | 0.692 |
| Skin dis | 11 | 2.23 | 1.77 | 2 | 0.058 | 1.282 | 2 | 0.527 |
| GIT par | 11 | 2.32 | 1.32 | 2.36 | 0.357 | 7.86 | 2 | 0.02 |
| External par | 8 | 1.88 | 2 | 2.13 | 0.016 | 0.25 | 2 | 0.882 |
| Systemic dis | 16 | 1.91 | 2.19 | 1.91 | 0.028 | 0.885 | 2 | 0.642 |

In Tigray, there was a significant moderate agreement (w=0.317, p=0.009) among groups that respiratory diseases mostly occur from February to May (Hagay) with a mean score of 16.1, followed by June to September (keremeti) and October to January with mean score of 9.4 and 9.3, respectively. They also strongly agreed (w=0.438, p=0.008) that most of the time skin diseases occur from June to September (Keremeti) with mean score of 10.7 followed by February to May (Hagay) and October to January (Kewie) with mean score of 4.6 and 2.6, respectively (Fig. 11, Table 15).

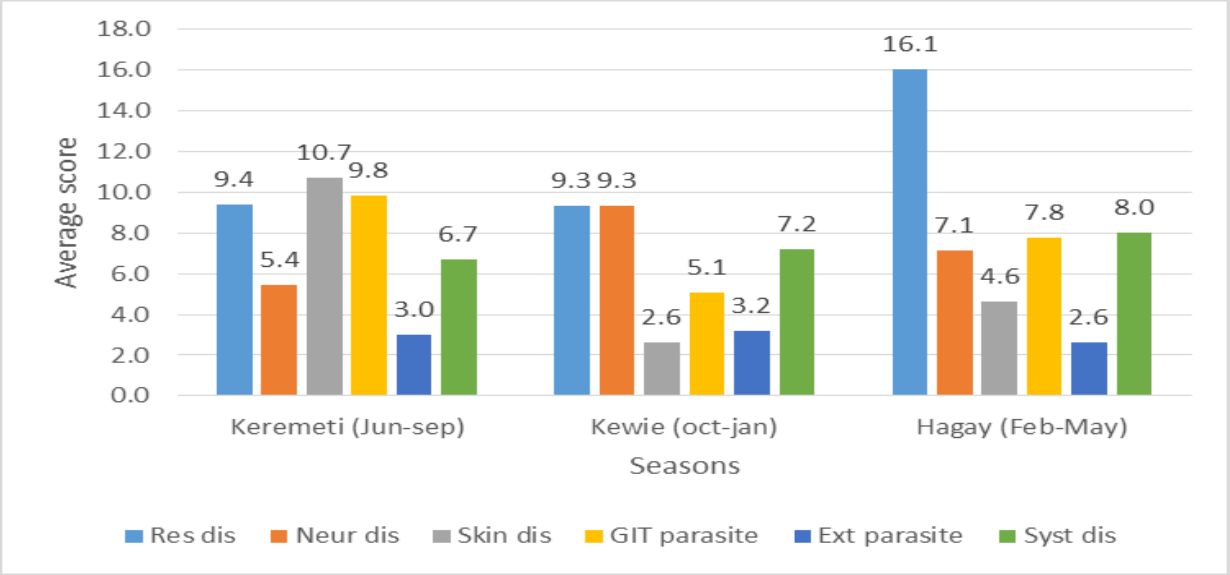


**Figure 11:** Seasonality of diseases based on average score in Tigray region.

**Table 15:** Agreement among FGD in Tigray region to determine seasonality of diseases

| Disease category | N | Mean rank score | | | Kendall's W[a] | Chi-Square | Df | Asymp. Sig. |
|---|---|---|---|---|---|---|---|---|
| | | Keremeti (jun-Sep) | Kewie (Oct-jan) | Hagay (Feb-May) | | | | |
| Respiratory dis | 15 | 1.67 | 1.70 | 2.63 | 0.317 | 9.5 | 2 | 0.009 |
| Neurological dis | 9 | 1.72 | 2.33 | 1.94 | 0.123 | 2.214 | 2 | 0.331 |
| Skin dis | 11 | 2.64 | 1.41 | 1.95 | 0.438 | 9.632 | 2 | 0.008 |
| GIT par | 12 | 2.33 | 1.63 | 2.04 | 0.129 | 3.106 | 2 | 0.212 |
| External par | 5 | 2.20 | 1.90 | 1.90 | 0.032 | 0.316 | 2 | 0.854 |
| Systemic dis | 10 | 1.95 | 1.95 | 2.10 | 0.008 | 0.158 | 2 | 0.924 |

a. Kendall's Coefficient of Concordance

In Oromia, farmers identified that diseases in neurological, skin, systemic disease category and GIT parasites occur seasonally (Fig. 12 and Table 16). GIT parasites mostly occur during the main rainy season and immediately after the rain. Neurological disease, like coenuruses, occurs mostly in the dry season from December to February. This could be linked to the breeding season of dogs, which is the final host of the parasite, since the presence of free roaming dogs on grazing land greatly contributes to the increasing incidence of the disease (Achenef et al., 1999).

Skin diseases were reported to occur mostly during the long rainy season due to weather related stress which could compromise the immune system. Sheep and goat pox is more common in the rainy season or dry cold season (AU-IBAR, 2015).

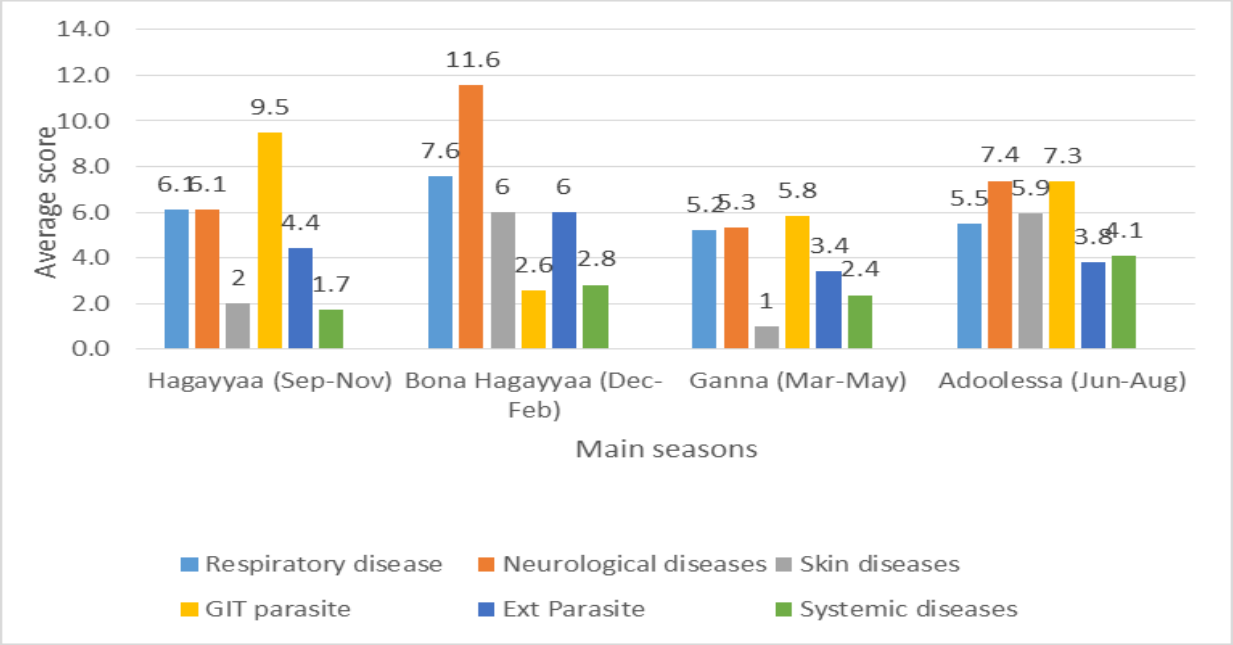


**Figure 12:** Seasonality of diseases based on average score in Oromia region.

**Table 16:** Agreement among FGD in Oromia region to determine seasonality of diseases

| Disease category | N | Mean rank score | | | | Kendall's W[a] | Chi-Square | Df | Asymp. Sig. |
|---|---|---|---|---|---|---|---|---|---|
| | | Hagayyaa (Sep-Nov) | Bona Hagayyaa (Dec-Feb) | Ganna (Mar-Apr) | Adoolessa (Jun-Aug) | | | | |
| Respiratory dis | 22 | 2.8 | 2.45 | 2.45 | 2.3 | 0.028 | 1.843 | 3 | 0.606 |
| Neurological dis | 16 | 2.19 | 3.44 | 2.00 | 2.38 | 0.274 | 13.159 | 3 | 0.004 |
| Skin dis | 12 | 2.25 | 2.38 | 1.96 | 3.42 | 0.272 | 9.785 | 3 | 0.02 |
| GIT par | 12 | 2.92 | 1.54 | 2.67 | 2.88 | 0.268 | 9.637 | 3 | 0.022 |
| External par | 5 | 2.00 | 2.80 | 2.50 | 2.7 | 0.078 | 1.163 | 3 | 0.762 |
| Systemic dis | 11 | 2.18 | 1.86 | 2.41 | 3.55 | 0.357 | 11.788 | 3 | 0.008 |

In SNNP, GIT parasites mostly occur during the main long and short rainy seasons, and neurological and respiratory diseases were reported for December to February (Fig. 13 and Table 17).

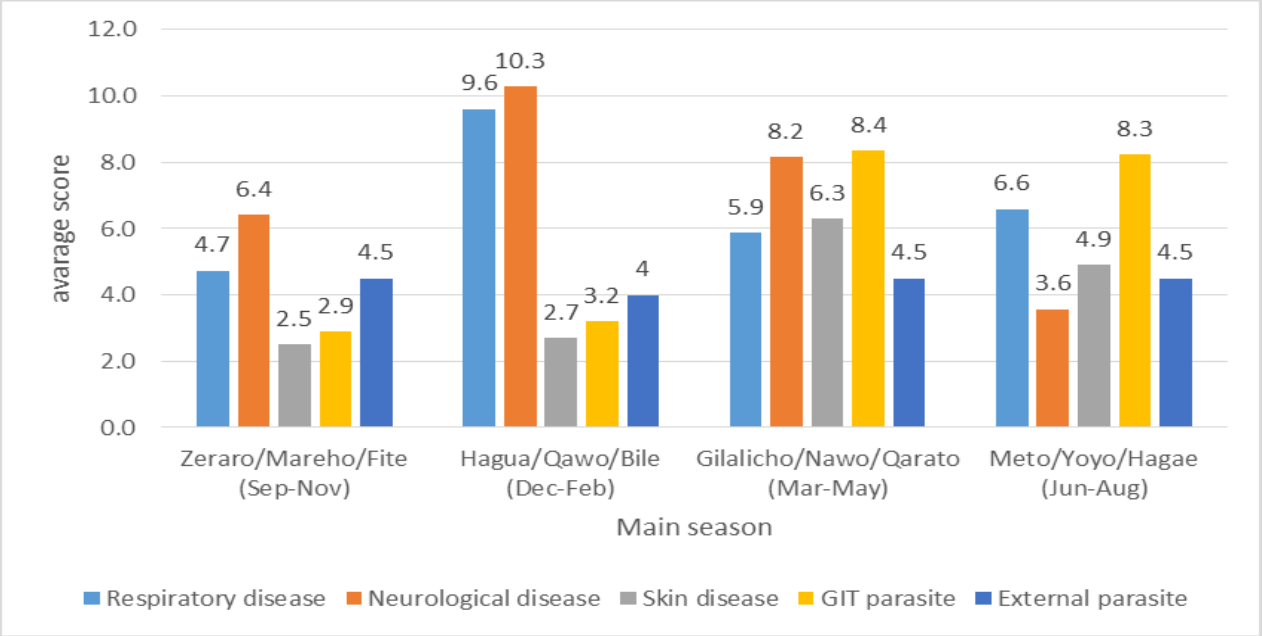


**Figure 13:** Seasonality of diseases based on average score in SNNP region.

**Table 17:** Agreement among FGD in SNNP region to determine seasonality of diseases

| Disease category | N | Mean rank score | | | | Kendall's W[a] | Chi-Square | Df | Asymp. Sig. |
|---|---|---|---|---|---|---|---|---|---|
| | | Zeraro/Marecho/Fite (Sep-Nov) | Hagua/Qawo/Bile (Dec-Feb) | Gilalicho/Nawo/Qarato (Mar-Apr) | Meto/Yoyo/Hagae (Jun-Aug) | | | | |
| Respiratory dis | 22 | 2.0 | 3.05 | 2.43 | 2.52 | 0.123 | 8.106 | 3 | 0.044 |
| Neurological dis | 6 | 2.67 | 3.42 | 2.50 | 1.42 | 0.445 | 8.02 | 3 | 0.046 |
| Skin dis | 10 | 1.90 | 2.35 | 3.25 | 2.50 | 0.242 | 7.269 | 3 | 0.064 |
| GIT par | 20 | 1.85 | 1.83 | 3.15 | 3.18 | 0.401 | 24.09 | 3 | 0.000 |
| External par | 8 | 2.00 | 2.38 | 3.38 | 2.25 | 0.257 | 6.176 | 3 | 0.103 |

## Impact of small ruminant diseases on households

Livestock diseases impose a wide range of biophysical and socio-economic impacts that may be both direct and indirect, and may vary from much localized to global problems (Thornton et al., 2002). Pritchett et al., (2005) pointed out that the economic impacts of animal disease could be categorized into six areas: production effects, market and price effects, trade effects, impacts on food security and nutrition, human health and the environment, and financial costs. Disease impacts are generally easy to identify but may be difficult to quantify.

In this study, the impact of these SR diseases were commonly described by farmers in terms of economic and financial loss, loss of productivity, impact on human health, migration for other jobs, wastage of time treating the animals, children drop out of school, malnutrition, social and psychological impact (Fig. 14), although, the magnitude of the impact on different household members varied between the regions.

Farmers described economic and financial losses as the loss of income from sale of animals and hides. Most of the time they cannot slaughter infected animals for consumption or sale in market. They also cannot sale hides from infected animals, and they explain that it is even not possible to use hides as a carpet at home if the animals were affected by disease like sheep and goat pox.

Some of the diseases are treatable but they explained that these incur expenses for treatment, which also affects the economy of a household.

Diseases like PPR, Anthrax and Pasteurellosis can cause high losses because of high mortality rates. This aggravates poverty for those whose livelihood is dependent on these animals. Some respondents reported that they were not able to send children to school anymore and it predisposes household members to migrate to towns or other areas in search for other work.

Farmers also explained that lambs and kids cannot get enough milk from diseased dams and may lead to death and thus reduce the flock size and greatly affect the productivity. In some areas, where goat milk is consumed, respondents mentioned that there is a drop in milk in diseases animals which affects the nutrition of their children.

They also explained the psychological impact that results from losing animals to diseases, because in most of the surveyed rural areas ownership of these animals determine one's social status, it serves as an indicator of wealth status. Once a disease is introduced to their sheep and goat flock it makes them hopeless to rear other livestock too.

The social impact was also recognized when they were unable to pay the tax and fertilizer cost and money for social practice called 'Idir' which can be characterized as traditional financial associations due to the loss of animals. A household who first encounters a disease in its flock will not be allowed by the neighbors to mix its herd on field grazing and watering. This sometimes creates social conflict.

The main threat to human health arises from Anthrax which farmers are familiar with under the local name 'Entit' in Amhara, 'Kankanto' in SNNP and 'Megerem' in Tigray. Farmers are not fully aware of the mode of transmission of Anthrax from animal to people. They believe that the disease is transmitted only when they consume fresh raw meat of infected animals. They consume air/smoke dried raw meat of infected animals called 'Quanta'. During the field work, people with typical skin lesion caused by the cutaneous form of anthrax in the studied low land areas of Amhara region were seen and seem to be common (Fig. 16). This is a clear evidence for the need to raise public awareness in this area of such a highly risky zoonotic diseases. As the spore of the bacteria causing the disease (*Bacillus anthracis*) is able to survive in harsh conditions in the environment for decades or even centuries (George Sternbach, 2003), the disease might continue to flare up under favorable conditions.

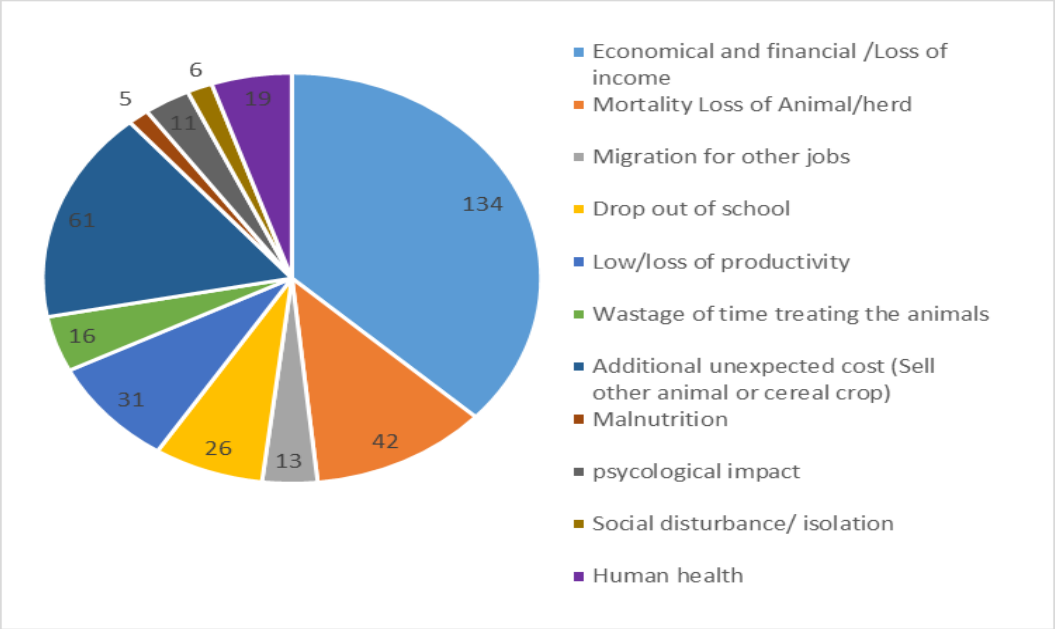


**Figure 14:** Socio-economic impacts described during FGD considering first and second priority disease category.

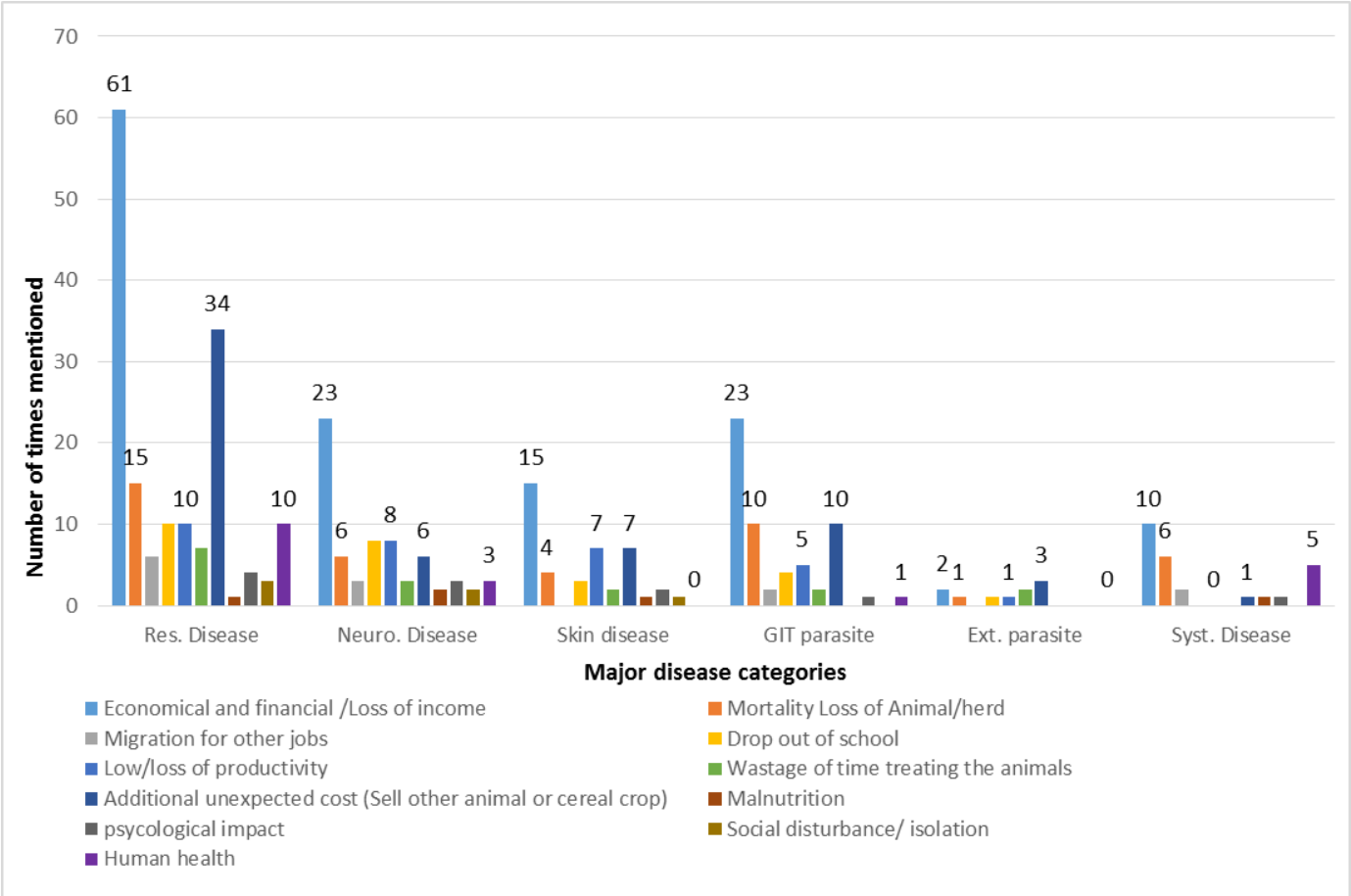


**Figure 15:** Socio-economic impacts by major disease categories.

The magnitude the above described impact have on different household members varied. The different respondent groups strongly agreed (w=0.515, p=0.000) (Table 19) that women are mostly impacted by small ruminant disease with mean score of 6.25 out of 20 (Table 18), followed by men with mean score of 5.7 out of 20.

Analysis gender disaggregated data about who said what about the impact on household members, indicated that women and young female expressed that it is women and young female who are the most affected by small ruminant disease in a household. The men and young male gave higher scores to men as the most affected group by these diseases, while still assigning high scores to women (Fig. 17).

Discussions on reasons for assigning different scores highlighted that it is women who bear the main responsibility of looking after diseased animals and taking care of children and that in order to look after the household, especially dealing with the food, they depend on income from small ruminants. Women do not have many option if animals are lost due to disease. Most importantly, low incomes and few resources mean that the women have few options available for managing crises, are less resilient to such shocks. They cannot go anywhere else to look for other work as they keep children at home. For men on the other hand it is easier find other work if for some reason animals are lost.

**Figure 16:** A FGD participant women in Amhara region, Abergelle Woreda affected by cutaneous anthrax (look the scars).

**Table 18:** Mean score and other descriptive statistics for impact of major disease categories on household members.

| | N | Mean | Std. Deviation | Minimum | Maximum |
|---|---|---|---|---|---|
| Men | 92 | 5.70 | 2.116 | 2 | 12 |
| Women | 92 | 6.25 | 1.380 | 3 | 10 |
| Youth male | 92 | 2.39 | 1.266 | 0 | 5 |
| Youth female | 92 | 2.60 | 1.205 | 0 | 7 |
| Children | 92 | 3.03 | 2.135 | 0 | 10 |

**Table 19:** Agreement among FGD based on impacts of major disease categories on household members.

| | Mean Rank score | Test Statistics |
|---|---|---|
| Men | 3.98 | N = 92 |
| Women | 4.36 | Kendall's W[a] = 0.515 |
| Youth male | 2.04 | Chi-Square = 189.468 |
| Youth female | 2.16 | Df = 4 |
| Children | 2.45 | Asymp. Sig. = 0.000 |

a. Kendall's Coefficient of Concordance

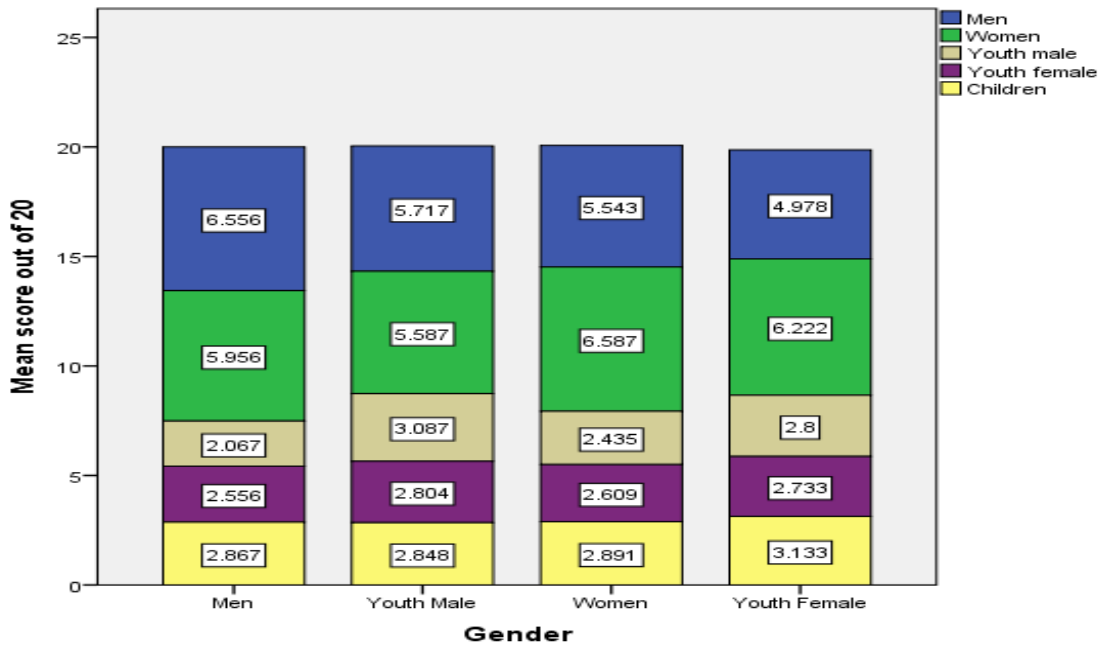


**Figure 17:** Who said what about the impact based on mean score out of 20?

**Table 20:** Agreement by each gender on impacts of major disease on household members.

| Gender | N | Mean rank score | | | | | Kendall's W[a] | Chi-Square | Df | p-value |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Men | Women | Youth male | Youth female | Children | | | | |
| Men | 23 | 4.13 | 4.26 | 1.74 | 2.24 | 2.63 | 0.553 | 50.912 | 4 | 0.000 |
| Young male | 23 | 4.15 | 4.24 | 2.20 | 2.15 | 2.26 | 0.518 | 47.660 | 4 | 0.000 |
| Women | 23 | 3.87 | 4.52 | 2.04 | 2.20 | 2.37 | 0.559 | 51.43 | 4 | 0.000 |
| Young female | 23 | 3.78 | 4.43 | 2.20 | 2.07 | 2.53 | 0.473 | 43.507 | 4 | 0.000 |

a. Kendall's Coefficient of Concordance

## Knowledge of the farmers about transmission of diseases and transmission pathways

The study found that farmers have in general good knowledge about transmission pathways. For the top two ranked SR diseases, the common transmission pathways or situations leading to transmission identified by FGDs participants were feeding and watering trough, barn, grazing area, market location, slaughter and skinning places and sucking.

For respiratory diseases transmission was mainly related to barn, during grazing, in market place and using communal feeding and watering trough. Farmers clearly identified that GIT parasites are mostly transmitted during grazing (Fig.18 and Table 21).

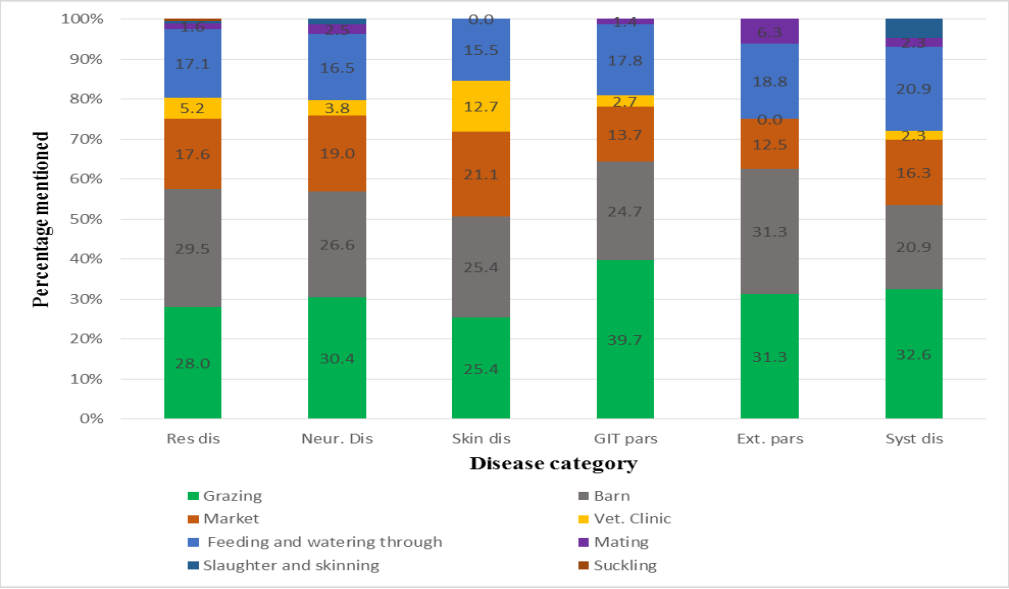


**Figure 18:** Major disease transmission pathways

**Table 21:** Agreement among FGD on transmission pathways of major disease categories

| Disease category | N | Mean rank score | | | | | | | | Kendall's W[a] | Chi-Square | Df | p-value |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Grazing | Barn | Market | Vet clinic | Feeeding and watering trough | Mating | Slaughtering and skining | Suckling | | | | |
| Respiratory dis | 70 | 6.21 | 6.38 | 5.06 | 3.69 | 5.01 | 3.29 | 3.18 | 3.18 | 0.506 | 247.92 | 7 | 0.000 |
| Neurological dis | 28 | 6.52 | 6.09 | 5.23 | 3.52 | 4.95 | 3.38 | 3.23 | 3.09 | 0.516 | 101.16 | 7 | 0.000 |
| Skin dis | 19 | 6.42 | 6.42 | 5.79 | 4.53 | 4.95 | 2.63 | 2.63 | 2.63 | 0.635 | 84.45 | 7 | 0.000 |
| GIT par | 33 | 6.91 | 5.58 | 4.61 | 3.64 | 4.97 | 3.52 | 3.39 | 3.39 | 0.525 | 121.24 | 7 | 0.000 |
| External par | 5 | 6.90 | 6.90 | 4.5 | 2.9 | 5.3 | 3.7 | 2.9 | 2.9 | 0.711 | 24.89 | 7 | 0.001 |
| Systemic dis | 16 | 6.66 | 5.41 | 4.91 | 3.41 | 5.41 | 3.41 | 3.66 | 3.16 | 0.462 | 51.71 | 7 | 0.000 |

a. Kendall's Coefficient of Concordance

## Involvement of different household members in disease transmission pathways

Once transmission pathways for major small ruminant diseases were identified, the relative level of contact/involvement of different household members in these transmission pathways was assessed.

Men received the highest scores for involvement in market related activities with a mean score of 8.3 out of 20 (Fig 22 and Table 22). Thus, for those diseases which can be acquired from market sources, for example PPR, men should be targeted in awareness creating activities about clinical signs, transmission and prevention. For activities related to barn, women and men got the same mean score of 5.4 out of 20. Women are responsible for cleaning the barn and men for construction of appropriate barn. Respondent groups moderately agreed (w= 0.26, p=0.000) that women are mostly involved in keeping the barns clean with mean rank score of 3.91 followed by men with mean rank score of 3.66 (Table 22). Therefore respiratory disease which are related with stress factors like suffocation and sanitation could be better addressed by targeting not only men but also women to provide advisory and extension services in this regards in addition to awareness creation.

Men still take the lead in feeding and watering as well as managing animals during grazing activities (Fig. 20). Thus men are relatively well aware of this disease transmission path more than others and thus play an important role in the management of internal parasites.

When disaggregating by gender to investigate who said what about the involvement of household members in the four major activities, interesting differences were identified. Men and young male assigned the highest scores to men in all four major activities. Women on the other hand, assigned higher scores to women for barn and feeding and watering activities and equal score for men and women for grazing activity, and the highest score for men in market activity. The young female group differed from women in so far as they gave higher scores to men for feeding and watering activity than to women (Fig. 21).

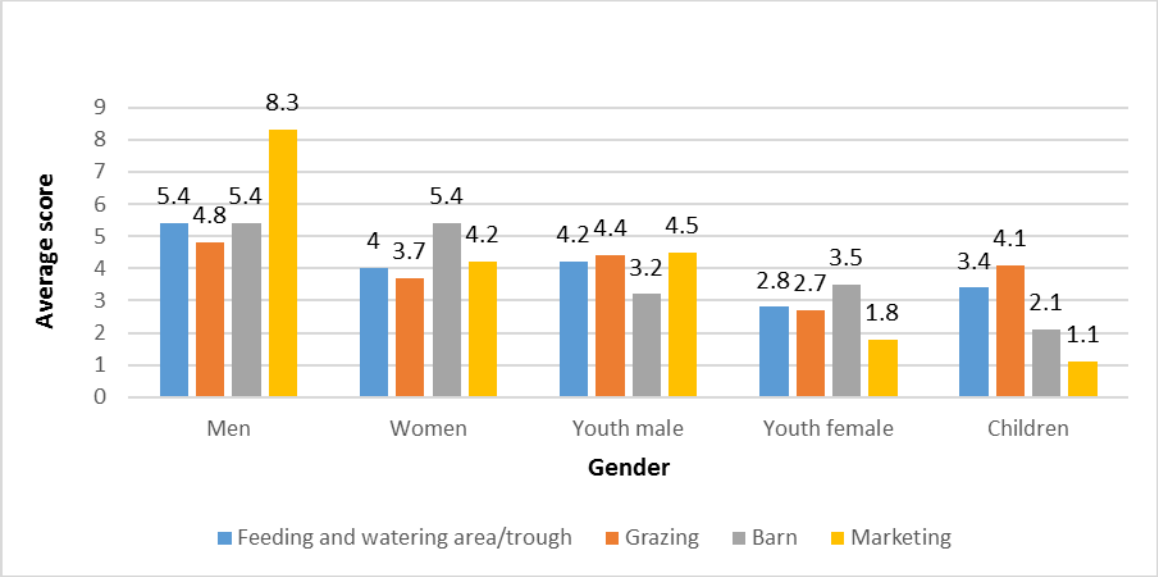


**Figure 20:** Involvement of household member in small ruminant related activity

**Table 22:** Agreement among FGDs on involvement of household members in activities which might be related with disease transmission

| Transmission pathways | N | Mean rank score | | | | | Kendall's W[a] | Chi-Square | Df | p-value |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Men | Women | Youth male | Youth female | Children | | | | |
| Feeding and watering | 107 | 3.66 | 3.09 | 3.15 | 2.50 | 2.60 | 0.094 | 40.166 | 4 | 0.000 |
| Marketing | 97 | 4.65 | 3.22 | 3.39 | 2.04 | 1.71 | 0.588 | 228.26 | 4 | 0.000 |
| Barn | 168 | 3.66 | 3.91 | 2.57 | 2.76 | 2.09 | 0.26 | 171.62 | 4 | 0.000 |
| Grazing | 146 | 3.44 | 2.82 | 3.21 | 2.33 | 3.21 | 0.083 | 48.54 | 4 | 0.000 |

a. Kendall's Coefficient of Concordance

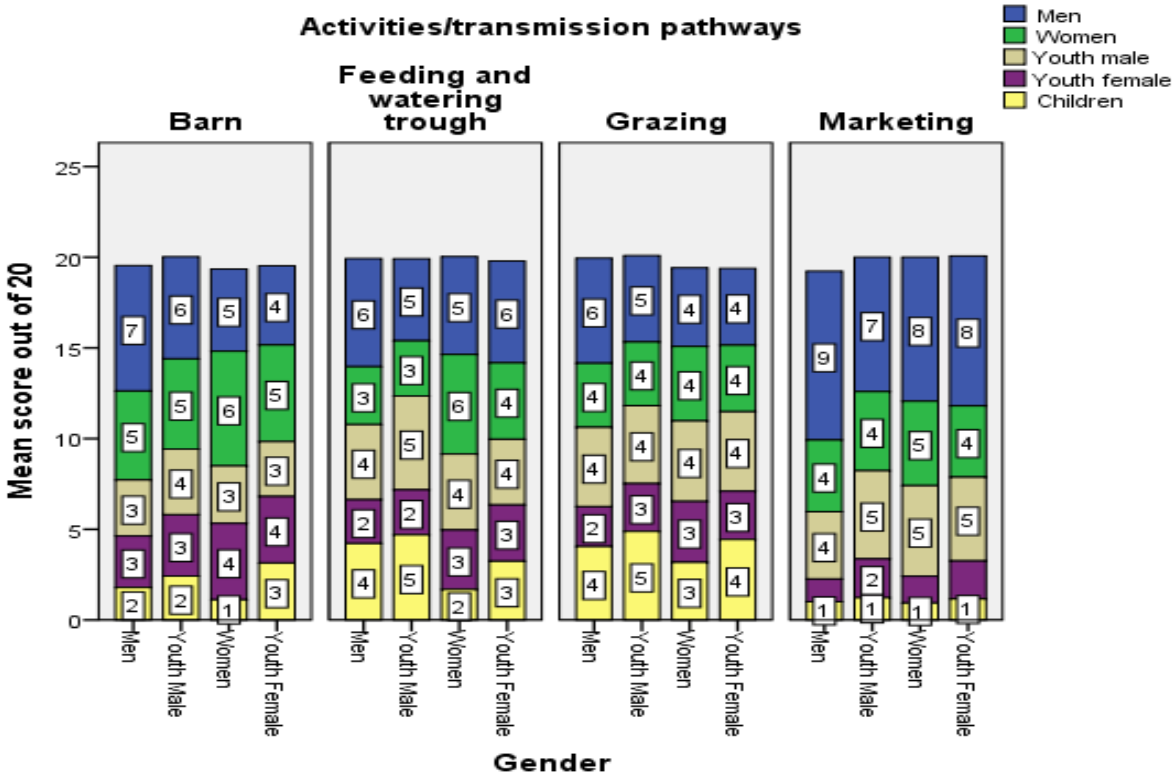


**Figure 21:** Who said what about the involvement of household members in four major activities/work distribution?

# Conclusions

Several livestock species play a significant role, but within these, small ruminants are generally the most important, often playing a more important role than cattle in the livelihood of the target community especially for the women and young.

Though confirmation through different laboratory investigation like serology is needed, farmers identified several diseases and syndromes with local names that affect small ruminants and grouped in to seven major disease categories according to their clinical manifestations, pasteurellosis, CCPP and coughing were repeatedly mentioned by different local names within the respiratory disease category. Coenurosis was the major disease raised in the neurological disease. Within the skin disease category, sheep and goat pox and orf were mentioned as priority diseases. Diarrhea was mentioned as a syndrome of GIT parasite. Liver fluke and lung worm were the most important parasite recognized by farmers. Mange mite, tick, lice and sheep ked were stated to be the common external parasite. PPR, Anthrax and Black leg were considered to be the major challenge and grouped in to systemic disease category. Some diseases, particularly coenuruses comes out to be top priority by specific gender within the community.

Farmers were also able to determine the seasonality of several disease prevailing in the area which help to predict the most appropriate time to plan preventive or curative interventions.

The impacts of these small ruminant diseases were commonly described by farmers in terms of economic and financial loss, loss of productivity, impact on human health, migration for other jobs, wastage of time treating the animals, children drop out of school, malnutrition, social and psychological impact.

The magnitude of the above described impact varies among household members. The farmers groups strongly agreed that women are mostly affected by small ruminant disease compared to other members of the household. The most repeatedly raised reason for this was, women bear the majority of the responsibility to taking care of children, fulfilling the need of the household specially dealing with family food, from the income of small ruminants. Most importantly, low incomes and few resources mean that the women have few options available for managing crises, are less resilient to shocks as a result of this diseases. Men have option to find other work outside if by some reason lost the animals. Moreover, women are more exposed to zoonotic diseases than other family members as a result of their gender specific roles in the SR production.

The perceptions of farmers' about disease causation was not rich rather they have good knowledge about the transmission pathways. Grazing, barn, market and feeding and watering trough were identified as the top ranked transmission pathways. In addition, the study revealed that theses transmission path ways are not neutral to household members rather it is gendered. In most cases, it is observed that particular gender in the household was involved in these activities which could implies that gender roles determine the involvement of household members in specific disease transmission pathways and level of exposure to zoonotic diseases. Men took great share to involve in market related activity than the other members of the household. Women are mostly involved in keeping the sanitation of the barn. Men still take the lead in feeding and watering as well as managing animals at grazing activities than the rest of the household members which can contribute to the management of internal parasite.

Based on the findings of this study, active laboratory investigation and serological survey of the key small ruminant diseases like PPR, CCPP and pasteurollosis should be conducted in order to identify and conduct appropriate site-specific interventions which potentially can be scaled out.

# References


Achenef, M., Markos, T., Feseha, G., Hibret, A. and Tembely, S. 1999. Coenurus cereberalis infection in Ethiopian highland sheep: incidence and observations on pathogenesis and clinical signs. *Tropical Animal Health and Production* 31(1): 15-24.

AU-IBAR. 2015. Standard Methods and Procedures (SMPs) for Sheep and Goat Pox (S and GP) in the Greater Horn of Africa, Nairobi.

Ballantyne, P.G. 2013. Targeting Action Research on Small Ruminant Value Chains in Ethiopia, Notes from three multi-stakeholder workshops. Nairobi: ILRI.

Catley, A. 2005. Participatory epidemiology: A guide for trainers. Nairobi: African Union/Interafrican Bureau for Animal Resources

Catley, A., Robyn G. Alders, James L.N. Wood. 2011. Participatory epidemiology: Approaches, methods, experiences. *Veterinary Journal*.

George Sternbach, MD. 2003. The history of anthrax. *Journal of Emergency Medicine*, 24 **(4),** 463-467**.**

Merck. 2010. Merck veterinary manual, 10th ed. Whitehouse Station: Merck Publishing.

Pritchett, J., Thilmany, D. and Johnson K. 2005. *International Food and Agribusiness Management Review* 8(1).

Putt, S.N.H., Shaw, A.P.M., Woods, A.J., Tyler, L. and James, A.D. 1988. Veterinary epidemiology and economics in Africa - A manual for use in the design and appraisal of livestock health policy. Reading: University of Reading.

Radostits, O, C Gay, K Hinchcliff, and P Constable. 2006. Veterinary medicine, a textbook of the diseases of cattle, sheep, goats, pigs and horses. London: Bailliere Tindal.

Siegel, S, and NJ Castellan. 1994. Nonparametric statistics for the behavioral sciences. New York: McGraw-Hill.

Thornton, P.K., Kruska, R.L., Henninger, N., Kristjanson, P.M., Reid, R.S., Atieno, F., Odero, A.N. and Ndegwa, T. 2002. Mapping poverty and livestock in the developing world. Chapter 5 Animal diseases and their impact on the poor. London.

# Annex 1 Important livestock species and priority disease list per project site

| Region | Project | Project sites/Woredas | Studied Kebeles | Priority LS species | List of top three diseases in SR (Local names) | Main clinical signs mentioned | Presumed scientific name |
|---|---|---|---|---|---|---|---|
| Amhara | LandF | Menz Gera | 07 | Sheep (w=0.689, p=0.017) | 1. Fentata<br>2. Engib/wotewut<br>3. Azurit | 1. Creates pea size swelling and wounds on the back of the tail and on the soft body of the animal, easily transmitted to uninfected flock, the hide could not be sold<br>2. nasal discharge, coughing and the lungs seems cooked when slaughtered, gasping respiration with abdominal movement, mostly occur after the rainy season during sunny weather<br>3. Separate from the flock, circling in one area, inclination, head carriage | 1. Sheep pox<br>2. Pasteurellosis<br>3. Coenurosis |
| | LandF | Menz Mama | 06 | Sheep (w=0.995, p=0.001) | 1. Engib/Wotewut<br>2. Azurit<br>3. Maule | 1. panting/gasping with abdominal movement, nasal discharge and their breath is hot, the lungs looks cooked and becomes foamy, they become febrile<br>2. Isolation from the flock, circling, no treatment found<br>3. bottle jaw, can be followed by diarrhea, can be fatal, liver fluke seen in slaughtered sheep, infected during grazing | 1. Pasteurellosis<br>2. Coenurosis<br>3. Liver fluke |
| | LandF | Ziquala | Bilaqu | Goat (w=0.907, p=0.003) | 1. Enetit<br>2. Sheleme<br>3. Tsebesa | 1. Sudden death of animals, we cannot see any sign in live animal except granting at the time of death, sometimes we have observed blood from the nose of dead animals, at slaughter we have observed swollen gallbladder, affect animals with good body condition<br>2. Diarrhea, Ocular discharge, Nasal discharge<br>3. Bad smelling diarrhea with mucous like secretion, debilitate the animal, it may lead to death | 1. Anthrax<br>2. PPR<br>3. Diarrhea |
| | LandF | Abergelle | Sazaba | Goat (w=0.886, p=0.021) | 1. Tatate/Enetit<br>2. Sheleme<br>3. Tsebesa | 1. Sudden death of animals, human who perform slaughtering acquire the disease, swollen gall bladder, the meat covered with dark blood and looks cooked<br>2. Lacrimation of the eye, sometimes blindness, nasal discharge, diarrhea, rough hair coat, the meat is bad smelling and cannot be consumed,<br>3. Bad smelling diarrhea with mucous like secretion, debilitate the animal, it may lead to death | 1. Anthrax<br>2. PPR<br>3. Diarrhea |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | AR | Basona Worena | Goshe bado | Sheep and Cattle (w=0.936, p=0.002) | 1. Engib<br>2. Fentata<br>3. Wodoma | 1. Tiredness, have fever, fast heart beat and respiratory rate, gasping with abdominal movement, raised hair coat, nasal discharge, the lungs is swelled and darkened than the normal, the superficial blood vessels is swelled and bad smelling from the body cavity<br>2. Small swellings throughout the body especially in the face area, under the tail, around the teat, highly transmitted, the skin cannot be sold<br>3. Emaciation, bottle jaw, observation of liver fluke | 1. Pasteurellosis<br>2. Sheep and goat pox<br>3. Liver fluke |
| | | | Gudo beret | Cattle (w=0.913, p=0.003) | | | |
| Oromia | LandF | Yabello | Derito | Goat (w=0.678, p=0.019) | 1. Sirgoo<br>2. Sombeessa<br>3. Qandhoo | 1. Circling, when opened the skull is full of water, recumbent for long time<br>2. Coughing, rapid breathing, abnormal color of the lungs, sticking of lungs with rib bones when opened<br>3. Observed whenever animals are parasitized with ticks, depression, unconsciousness, shivering, recovers when treated, | 1. Coenurosis<br>2. CCPP<br>3. - |
| | | | Elewaya | Goat (w=0.415, p=0.14) | | | |
| | LandF | Horro | Gitilo Dale | Sheep (w=0.942, p=0.002) | 1. Furroo/Bubutaa Cacabsaa/ Argansoo<br>2. Jiitoo<br>3. Lafan Martoo | 1. Coughing, nasal discharge, dullness, rough hair coat, swelling of the face, deep breathing and shivering of the body<br>2. Bottle jaw, emaciation and depression, diarrhea, observation of liver fluke, can lead to death<br>3. Circling, recumbency, convulsion, cannot be treated | 1. Pasteurollosis/CCPP<br>2. Liver fluke<br>3. coenurosis |
| | | | Lakku iggu | Cattle (w=0.957, p=0.002) | | | |
| | AR | Sinana | Ilu sambitu | Cattle and equine (w=0.943, p=0.002) | 1. Furroo/Surridoo<br>2. Cittoo<br>3. Abdarraa | 1. Coughing, sneezing, difficulty in respiration, swollen abnormal lung, purulent nasal discharge<br>2. Unthriftness, lagging behind the herd, alopecia, crust on the skin, transmitted rapidly, itching, scaly formation at the site of lesion<br>3. Swelling of the lips, scab lesion on muzzle area , inappetance, depression , the lesion on lips extends to the tip of ear and foot cleft, in appetence | 1. Pasteurellosis<br>2. Mange mite<br>3. Orf |
| | | | Selka Bakaye | Cattle (w=0.85, p=0.004) | | | |
| SNNP | LandF | Doyogena | Ancha Sadicho | Sheep (w=0.8, p=0.007) | 1. Ganshua<br>2. Lomme'eta/wochiwocha<br>3. Kurkursa | 1. Coughing, nasal discharge, swelling of the face, lead to death<br>2. Watery diarrhea, loss of body condition, death occurs at a time of feed shortage, swelling around the neck<br>3. Scab lesions and swelling on muzzle area, | 1. Pasteurollosis<br>2. GIT parasite/liverfluke<br>3. Orf |
| | | | Hawara Arara | Cattle (w=0.775, p=0.008) | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | | | decreased feeding, not a killer disease | |
| | LandF | Adiyo | Boka | Sheep (w=0.951, p=0.002) | 1. Oshiyo<br>2. Boko hucha/Qele Gudo/<br>3. Macho achi cheno/Mecho Nefo | 1. Coughing, nasal discharge, swelling of head loss of body condition, lead to death<br>2. Circling, recumbency, head carriage, lead to death<br>3. Dropping of heads towards the ground, emaciations, abdominal distention, foam in the mouth, partial paralysis of the back · unable to stand, swelling of the head | 1. Pasteurollosis<br>2. Coenurusis<br>3. - |
| | | | Shuta | Sheep (w=0.921, p=0.002) | | | |
| | AR | Lemo | Jawe | Cattle (w=0.859, p=0.004) | 1. Adora<br>2. Ganshua<br>3. Kurkusa | 1. Emaciation, watery bad smelling diarrhea, can lead to death, loss of appetite<br>2. Deep coughing, purulent nasal discharge, loss weight, depression, loss of appetite<br>3. Wounds around lips and muzzle, prevents to eat properly, loss of body condition | 1. Diarrhoea/internal parasite<br>2. Pasteurollosis<br>3. Orf |
| | | | Upper Gana | Cattle (0.893, p=0.003) | | | |
| Tigray | LandF | Atsbi Wonberta | Golgol Naele | Sheep (w=0.936, p=0.002) | 1. Halkafean/Tegta/Mieta<br>2. Zarti/Hsake Resi/kenin/Azar/Aqnine<br>3. Efeel/Haseka Kebdi | 1. Nasal discharge, fast breathing, acute death<br>2. Isolation from the herd, circling, bending of its head to one side<br>3. Diarrhea, weakness, depression, loss of body weight, fluke in the liver observed | 1. Pasteurellosis<br>2. Coenurosis<br>3. Liver fluke |
| | | | Asbi Habess | Sheep (w=0.936, p=0.002) | | | |
| | LandF | Tanqua Abergelle | Hadnet | Goat (w=0.864, p=0.004) | 1. Halkafean/Tegta<br>2. Tsehtsah/weqie<br>3. Shihure/Bededo/Shilimat/Enfrir | 1. Grunting, diarrhea, acute death, the superficial blood vessels is swelled and cooked appearance of the gut<br>2. Diarrhea, lacrimation, blindness, nasal discharge, wound in mouth and tongue<br>3. Nodular lesions on the body, serious in lambs and kids, abortion in pregnant ewes, rough hair coat, loss of body weight | 1. Pasteurellosis<br>2. PPR<br>3. Sheep and goat pox |
| | AR | Endemehoni | Emba Hasti | Goat (w=0.979,p=0.002) | 1. Halkafean/Tegta/Mieta<br>2. Tsihtsah/Gurgurit<br>3. Shihure/Bededo/Shilimat/Enfrir | 1. Rough hair coat, fast breathing, anorexia, acute death, hemorrhage and bad smell in the body cavity, the intestine becomes fragile<br>2. Bad smelling diarrhea mixed with mucus, loss of body weight<br>3. Nodular lesions on the body, patchy hair loss, serious in lambs and kids, abortion in pregnant ewes, rough hair coat, loss of body weight | 1. Pasteurellosis<br>2. GIT parasite<br>3. Sheep and goat pox |
| | | | Tsibet | Sheep (w=0.936, p=0.002) | | | |