

Safe Food, Fair Food: Selected diseases of sheep and goats in the Ethiopian value chain



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Presentation at a meat inspectors' training course, Debre Zeit, Ethiopia
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Presentation outline

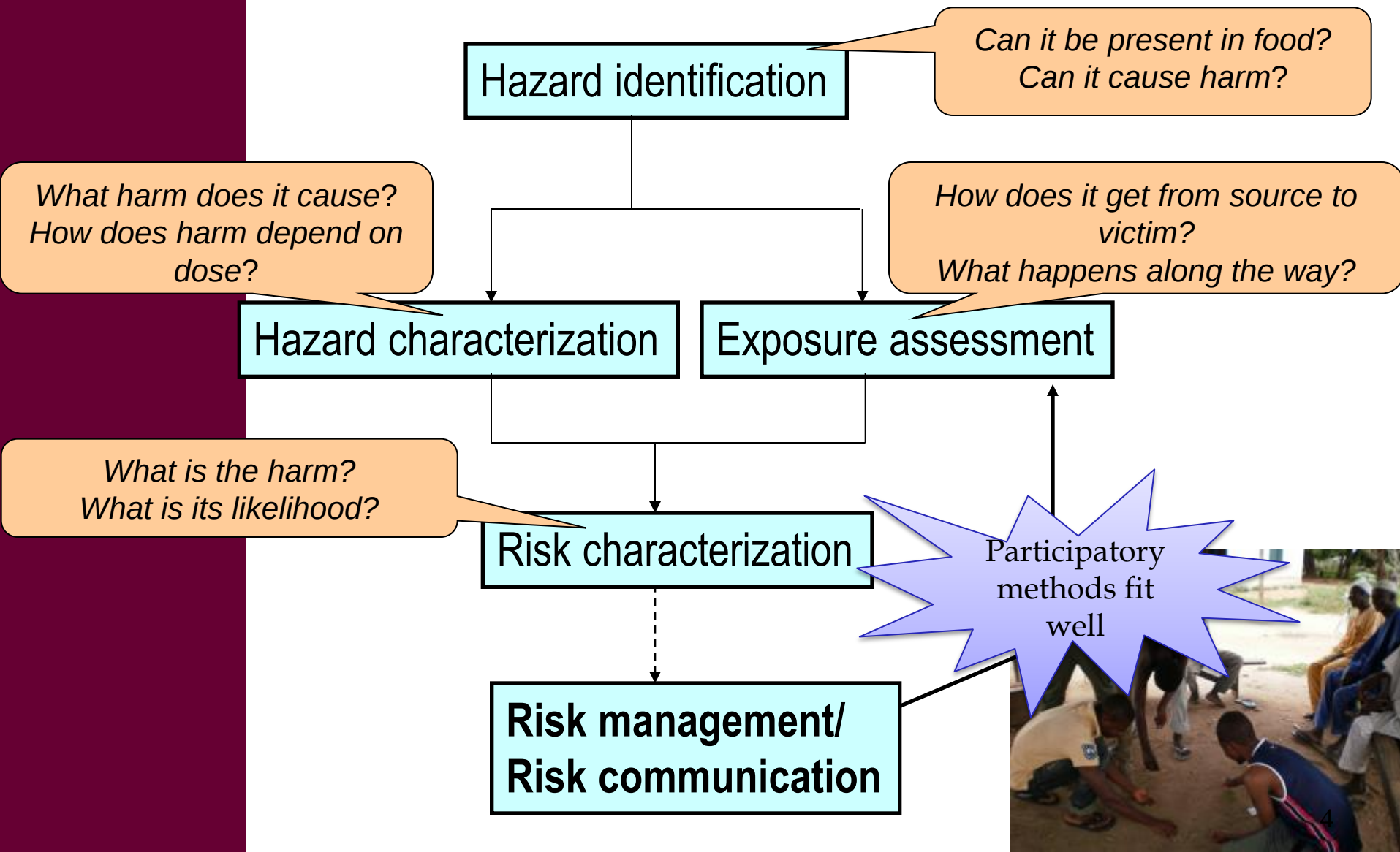
- Objectives and goals of SFFF
- Timeline of activities
- What has been done
- Results so far
- Current and future work
- Selected parasitic, metabolic and production diseases of sheep and goat

Safe Food, Fair Food

- Risk-based approach to food safety
 - Structured way of evaluating and dealing with risks
 - Identifies major risks in food value chain from farm to fork (multidisciplinary)
 - Identifies most useful points of intervention
- Training of meat inspectors



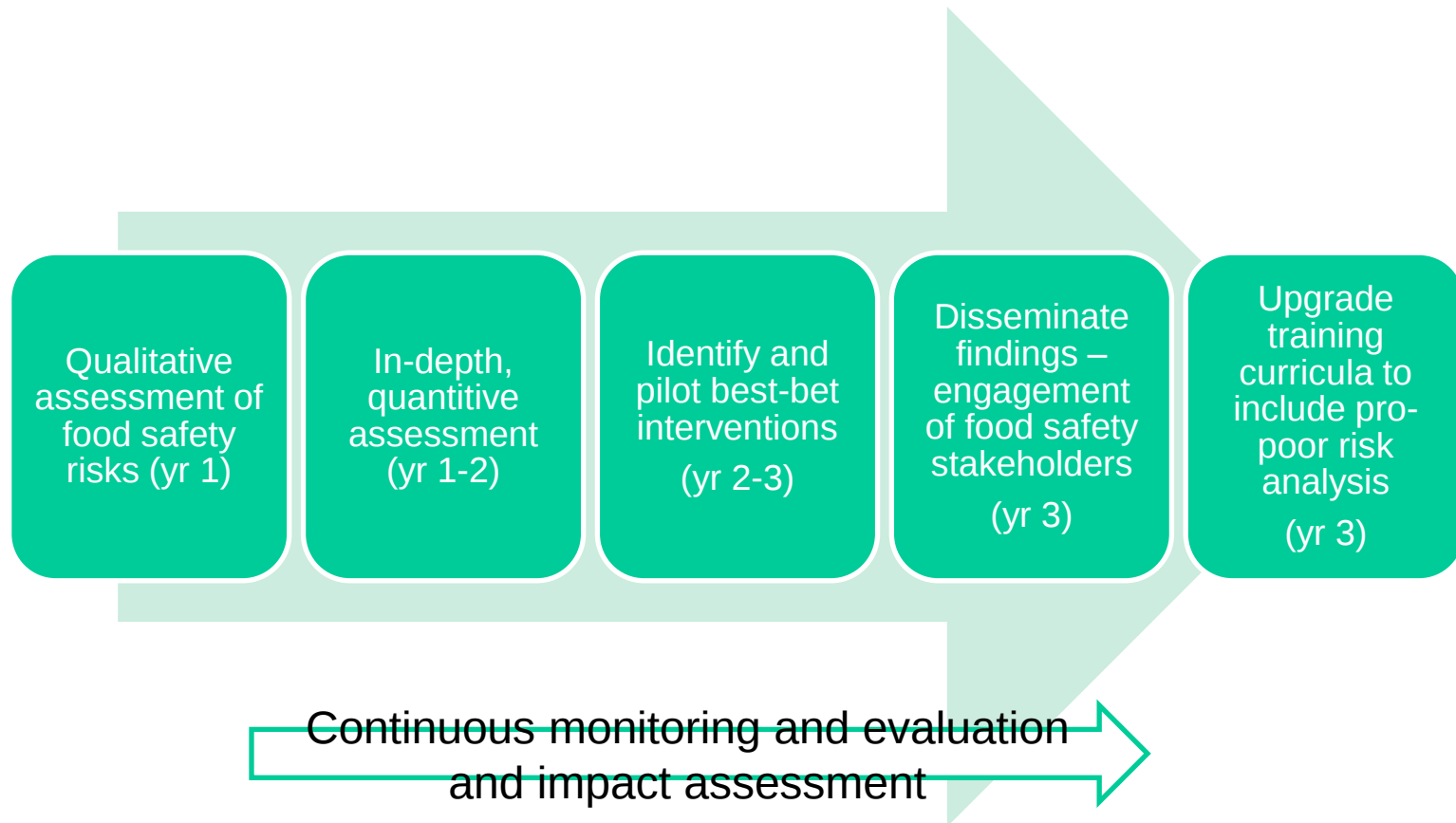
Codex Alimentarius framework for food safety risk assessment



Study sites in Ethiopia

#	VCs	District	Sites/villages/ communities	Region
Highlands				
1	Sheep 1	Atsbi	1. Habes 2. Golgol na'ele	Tigray
2	Sheep 2	Doyogena	1. Serea 2. Bkafa	SNNP
3	Sheep 3	Menz	1. Molale 2. Mehal Meda	Amhara
4	Sheep 4	Horro/Shambu	1. Gitlo 2. Lakku Iggu	Oromia
5	Goat 1	Abergelle	1. Sazba (Amhara) 2. Felegehiwot (Tigray)	Amhara/ Tigray
Lowlands				
6	Goat 2	Yabello (Borana)	1. Eleweya 2. Darito	Oromia
7	Goat/Sheep	Shinelle	1. Gad 2. Degah Jebis	Somalia

Strategy & Timeline



Qualitative assessment of food safety in the value chain

- Participatory Rural Appraisals and Focus Group Discussions
 - Topics included animal health, consumption patterns, food preparation, and perceptions of quality and safety of meat and milk
- Outputs
 - ASF production and consumption cycles and constraints on these
 - Food selection and handling practices
 - Risk awareness and management

Food safety risks

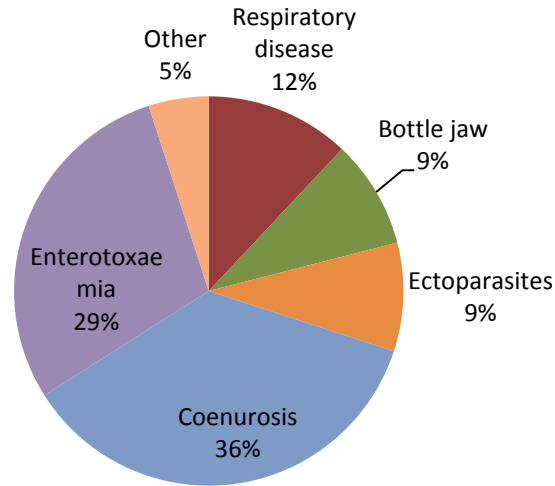
- Low level of consumption of ASF
 - Nutritional deficiencies
 - Gender differences in consumption
- Consumption of raw and/or lightly cooked meat
- Consumption of raw milk
- Consumption of sick animals
- Drug residues in meat

Constraints on animal production

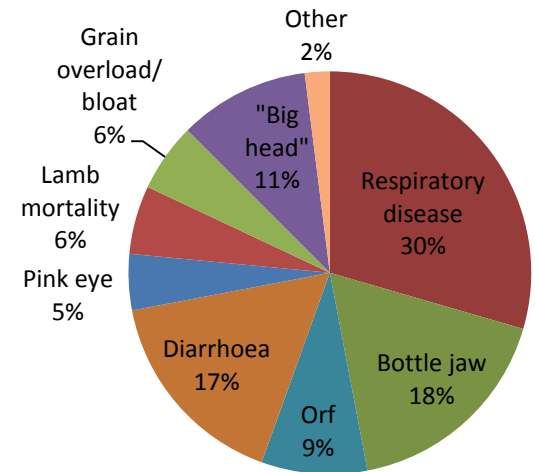
- Major constraints on production is disease and lack of feed
- Most important health problems are respiratory disease, ecto-, and endoparasites
 - Site-dependent variation

Proportional morbidity in sheep

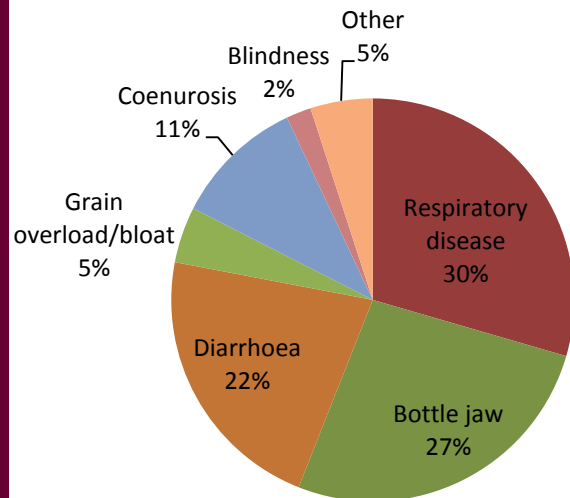
Atsbi



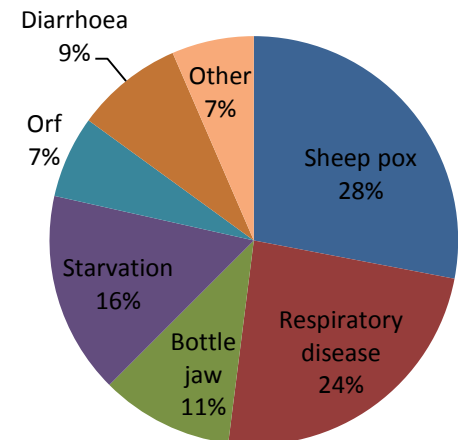
Doyogena



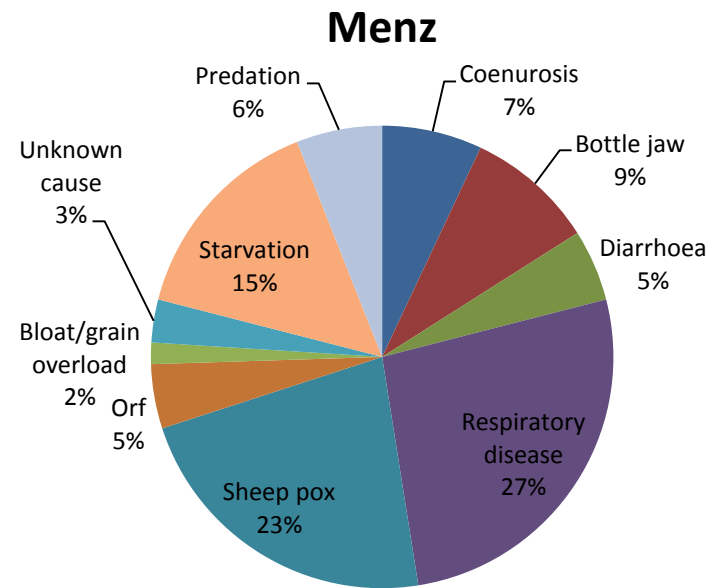
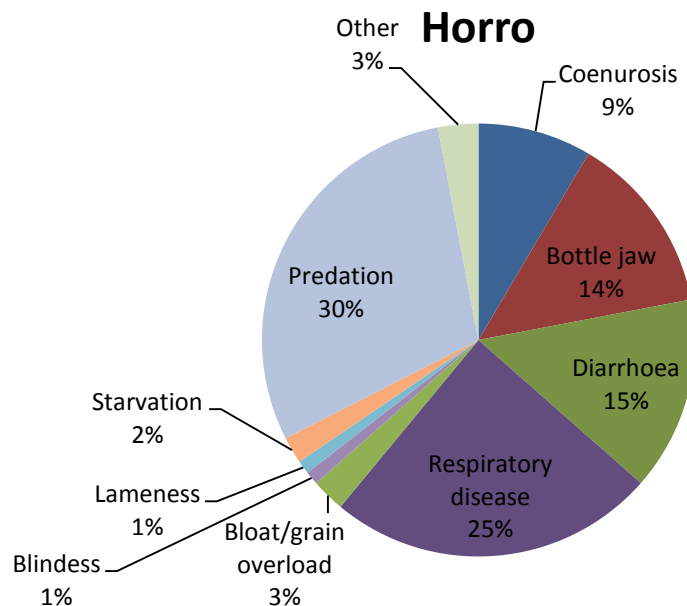
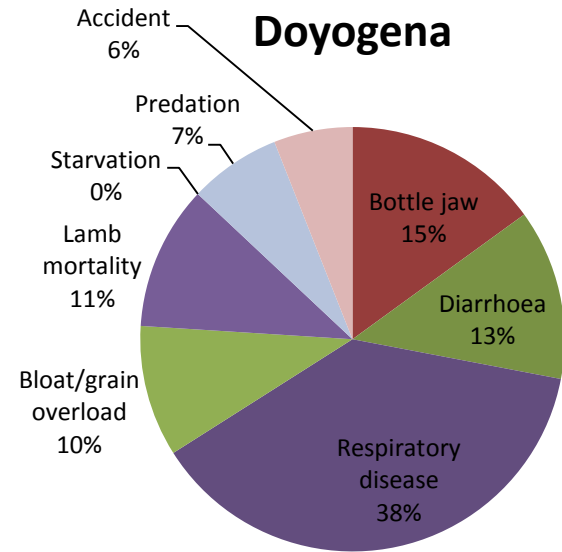
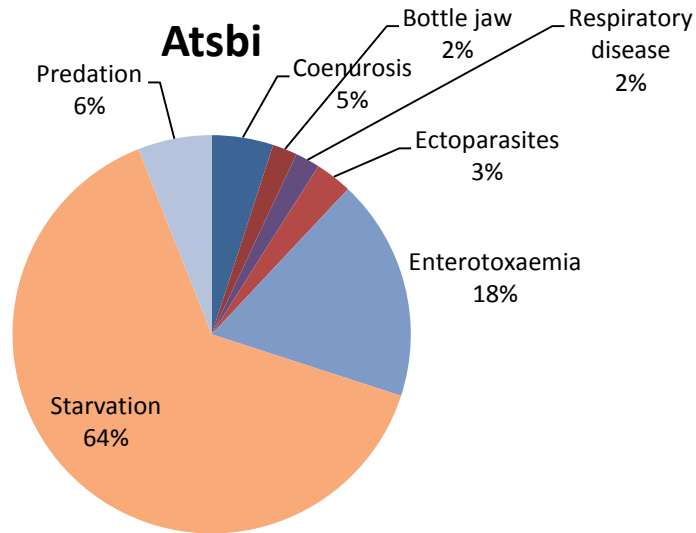
Horro



Menz

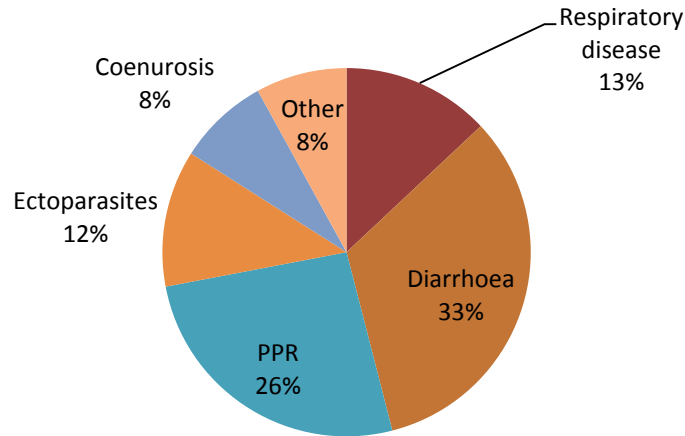


Proportional mortality in sheep

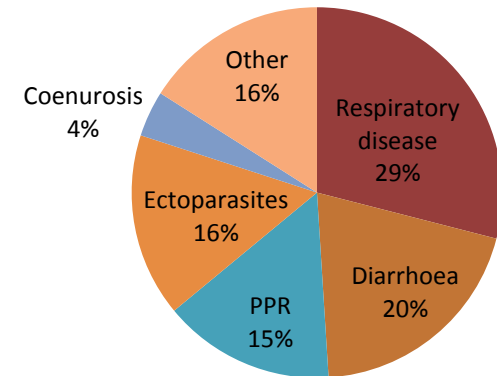


Proportional morbidity in goats

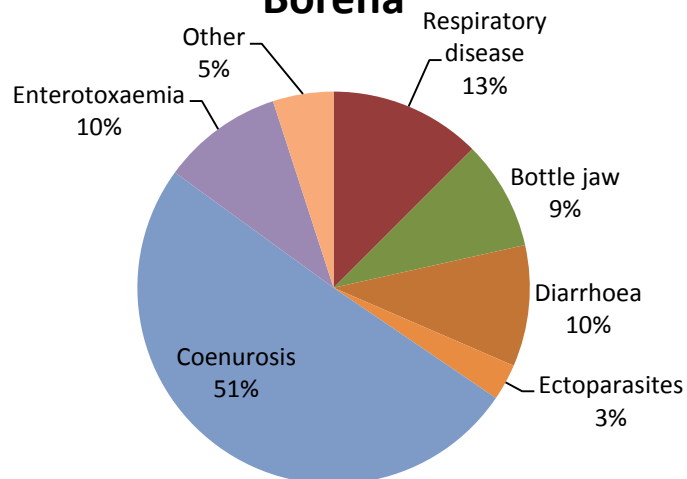
Abergelle Amhara



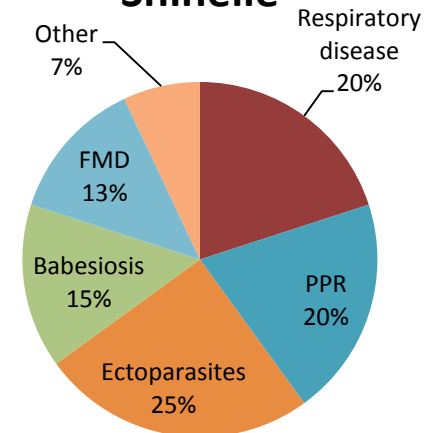
Abergelle Tigray



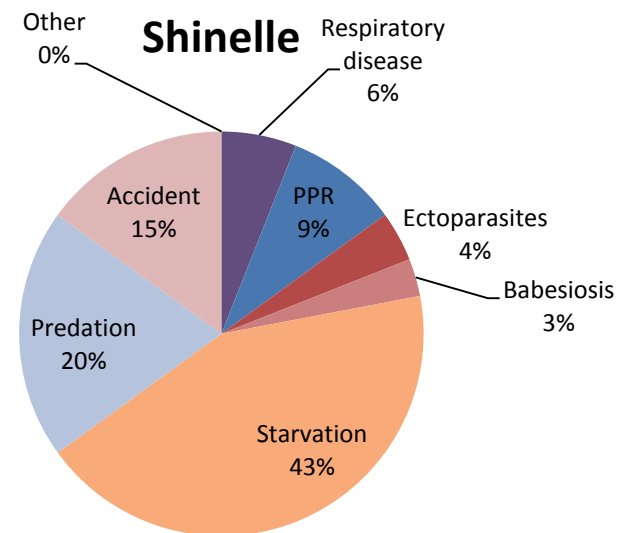
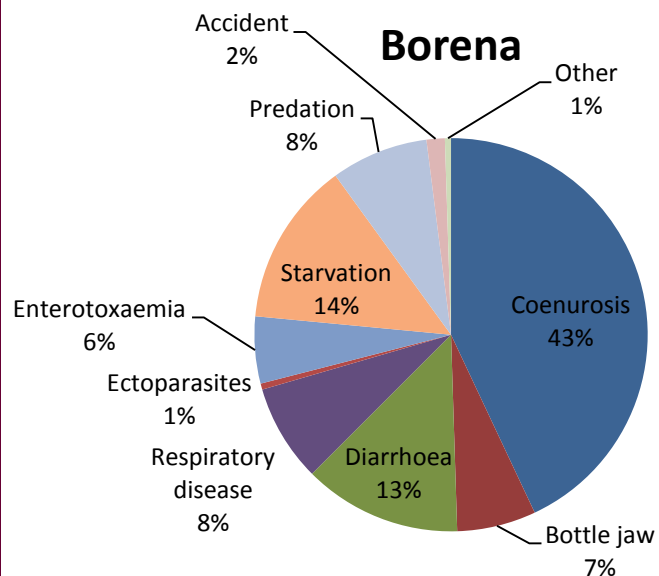
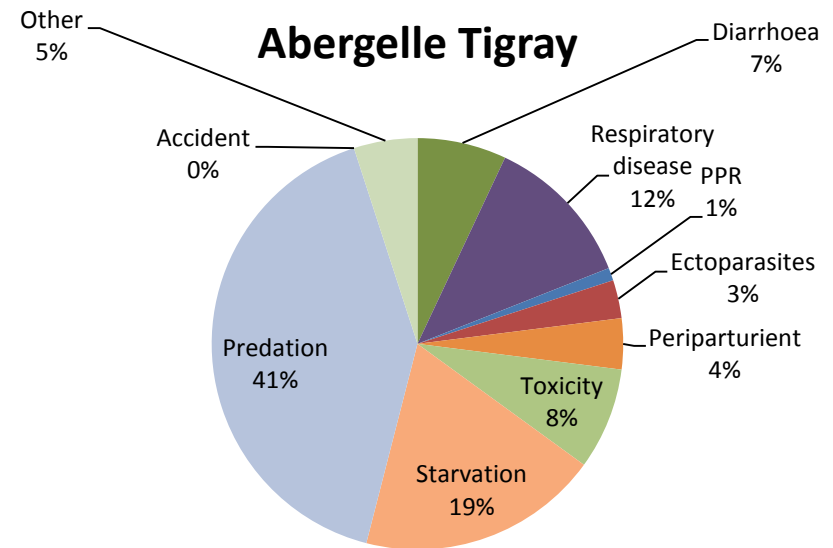
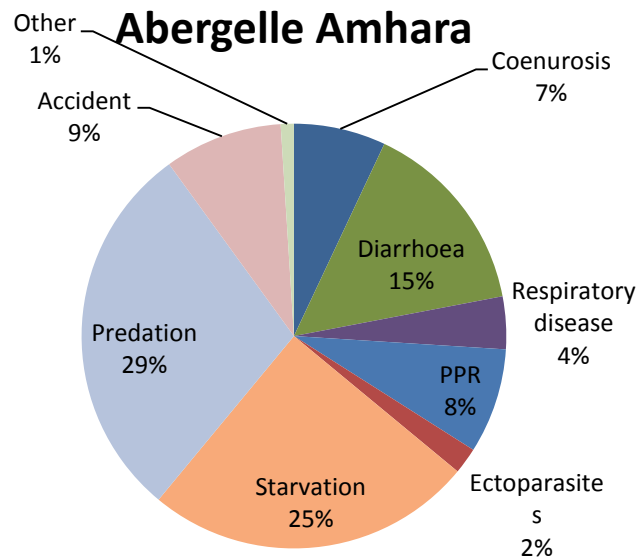
Borena



Shinelle



Proportional mortality in goats



Quantitative risk assessment

- Questionnaires for producers, consumers and value chain actors
- Biological sampling in abattoirs
 - Coliforms, E. coli 0157:H7
 - Campylobacter
 - Salmonella
 - antimicrobial resistance

Future work

- Identify best-bet interventions
- Pilot study of intervention
- Activities at regional level – engaging food safety stakeholders to promote an enabling environment for pro-poor food safety management
- Upgrading academic and training curricula

Safe Food, Fair Food



Outline of diseases presented

- Foot rot
- Respiratory diseases
- Orf
- Enterotoxemia
- Endoparasites
- Ectoparasites

Foot rot

- Infectious bacterial disease of sheep that causes severe lameness and economic loss from decreased flock production
- *Bacteriodes nodosus*, lives in hoof of infected animals; survives up to 2 weeks in the environment
- Clinical signs: lameness, area between toes becomes moist and red, foul odor

Foot rot progression



Photos by Dr. Clell Bagley, D.V.M., and Utah State University

Foot rot epidemiology

- Introduced by purchase of an infected animal or by using facilities that have been contaminated by infected sheep
- Spread from infected sheep to the ground, manure, bedding, etc., where it is then picked up by noninfected sheep
 - Spread occurs best when temperatures are from 15-25 C and the environment is wet

Foot rot treatment and prevention

- Vaccination, antibiotics, regular foot trimming, and footsoaks/baths
- *Bacteroides* can only live in the hoof of an infected animal or in the soil for no more than 14 days
- It is possible, through careful management procedures, to avoid introducing foot rot into a flock and/or eliminate the disease if the flock is infected

Foot rot prevention

- Never buy sheep with foot rot or from a flock infected with foot rot, even if the animal(s) appear unaffected
- Avoid buying sheep at sale yards or livestock markets where clean and infected sheep may have been commingled or run through the same area
- Avoid using facilities (trails, corrals, dipping areas) where infected sheep may have been in the last two weeks
- Never transport sheep in a vehicle that has not been properly cleaned and disinfected
- Trim and treat the feet of all new arrivals, then re-examine them periodically

Foot rot prevention



Veterinary Surgeons Board Of Western Australia

Respiratory disease in sheep and goats

- Signs: coughing, difficulty breathing, weight loss, nasal discharge
- As a general rule, transmitted by aerosol and secretions
- Potential causes:
 - Viral
 - Maedi-visna; jaagsiekte
 - Bacterial
 - CCPP, Pasteurellosis
 - Parasites
 - Lungworms
- Often diagnosis can only be made post-mortem
- Treatment depends on agent:
 - Antibiotics for bacterial; no treatment for viral; anthelmintics for worms

Pasteurellosis

- Caused by *Pasteurella/Mannheimia haemolytica* bacteria
- Clinical signs:
 - Systemic illness: acute onset depression, lethargy and inappetence, the animal is found dead
 - Chronic respiratory disease

Pasteurellosis

- Diagnosis of respiratory disease caused by *P./M. haemolytica* is based upon clinical signs
- Confirmation of diagnosis is made at necropsy with histopathological examination of lung lesions and bacteriology
- Treat with oxytetracycline

Pasteurellosis epidemiology

- In order for these organisms to cause infection, a combination of stressors (heat, overcrowding, exposure to inclement weather, poor ventilation, handling, and transportation) leaves sheep and goats susceptible to respiratory viral infections
- The combination of stressors and primary infections break down the mucosal barrier integrity of the lower respiratory tract, allowing *M. haemolytica* to colonize, proliferate and induce significant tissue damage



Pasteurellosis prevention

- Inclusion of prophylactic antibiotics, mainly tetracycline, in the feed during the months of the year with the highest incidence
- Avoidance or reduction of known stressors

CCPP

- Contagious caprine pleuropneumonia is a contagious disease of goats caused by *Mycoplasma capricolum* subsp. *Capripneumoniae* (F18 Biotype)
- One of the most severe diseases of goats
- Mortality can be as high as 80% in native flocks

CCPP

- Outbreaks of the disease often occur after heavy rains , after cold spells or after transportation over long distances
 - This may be because recovered carrier animals shed the infectious agent after the stress of sudden climatic or environmental changes
- A carrier state is likely but not proven

CCPP – clinical signs

- Peracute form: affected goats may die within 1–3 days with minimal clinical signs
- Acute: high fever, lethargy, frequent coughing, nasal discharge
- Chronic: chronic cough, nasal discharge

CCPP control and treatment

➤ ***Treatment***

- Treatment of sick animals with broad spectrum antibiotics

➤ ***Prevention***

- Ring vaccination of CCPP vaccine is given around the outbreak sites. The National Veterinary Institute (NVI) at Debre Zeit produces a limited amount of CCPP vaccine
- Restriction of movement of goats from and to the outbreak areas is necessary to prevent spread of the disease

Lungworms

- Caused by *Dictyocaulus filari*
- Prevalent in highlands and semi-highlands in Ethiopia
- Eggs are laid in the lungs, coughed up and swallowed, then passed out in the feces
- Clinical signs are coughing and difficulty breathing
- No fever

Orf, sore mouth

- Zoonotic viral disease
- Affected lambs or kids may spread disease to mother's udder
- Ewes/does refuse to suckle lamb/kids which may starve



Enterotoxemia

- Caused by two strains of *Clostridium perfringens* – types C and D
 - These bacteria are normally found in low numbers in the gastrointestinal tract of all sheep and goats
- Cause of disease is a sudden change in the diet of the animal
 - an increase in the amount of grain, protein supplement, milk or milk replacer (for lambs and kids), and/or **grass** that the sheep or goat is ingesting
 - these feeds are rich in starch, sugar, and/or protein
 - *Clostridium perfringens* undergoes explosive growth within the intestine and releases very potent toxins
 - Toxins damage intestines and other organs

Enterotoxemia – clinical signs

- The animals may abruptly go off of feed and become lethargic
- Signs of abdominal pain
 - kicking at their belly, repeatedly laying down and getting up, laying on their sides, panting, and crying out
- Diarrhea, blood in the loose stool
- Animals may lose the ability to stand, lay on their sides, extend their legs, with their head and neck extended
 - This posture is caused by the effects of the toxins on the brain. Death commonly occurs within minutes to hours after this sign is seen
- Can progress so quickly, animals may be found dead with no previous signs of disease



Enterotoxemia – treatment and prevention

- Mild cases with analgesics, probiotics, oral electrolyte solutions, and antisera (a solution of concentrated antibodies that neutralize the toxins)
- **Vaccination** is the cornerstone to prevention
 - For sheep and goats, there are multiple vaccines available that induce immunity to the toxins generated by *Clostridium perfringens* types C and D

Enterotoxemia prevention

- **Smart feeding strategies:** give small portions of high risk feeds
- **Always make feed changes slowly**
 - For animals being turned out onto pasture after being fed hay or other stored feeds, begin by allowing only about 10 minutes of grazing time on the first day. Double this with each subsequent day – it will take about a week for them to work up to a full 24 hours on pasture.

Endoparasites

- Worms = Helminths
 - Roundworms=Nematodes
 - Both adult and larval forms live in GI tract of the same host
 - Flatworms
 - Tapeworms=Cestodes
 - Larval infection in intermediate host
 - Adult forms reproduce in definitive host
 - Liver flukes=Trematodes
- Signs of internal parasites: poor condition, pale mucous membranes, bottle jaw
- Condemnation of carcass is major economic loss
- Diagnosis: eggs in feces of definitive host; post-mortem in intermediate host

Condemnation rates in abattoir

	Organs condemned						
Sheep	N examined	liver		lung		carcass	
		N	%	N	%	N	%
Young	488	261	54	196	40.6	22	4.6
Adult	664	413	61.7	317	47.4	55	8.2
Total	1152	674	58.5	513	44.5	77	6.7
Goat							
Young	659	259	39.3	184	27.9	46	7
Adult	877	414	47.2	456	52	65	7.4
Total	1536	673	43.8	640	41.7	111	7.2
Overall	2688	1347	50.1	1153	42.9	188	7

T. Jibat et al. Causes of abattoir condemnation in apparently healthy slaughtered sheep and goats at HELMEX abattoir, Debre Zeit, Ethiopia. *Revue Méd. Vét.*, 2008, 159, 5, 305-311.

Liver condemnation in sheep

	Sheep (n=1152)					
	Young		Adult		Total	
	N	%	N	%	N	%
Fasciolosis	25	5.2	55	8.3	80	6.9
Cirrhosis	13	2.7	23	3.5	36	3.1
Hepatitis	73	15.1	130	19.6	203	17.6
Stelesia hepatica	50	10.4	58	8.7	108	9.5
Cysticercus tenuicollis	22	4.6	39	5.9	61	5.2
Calcifications	16	3.3	44	6.6	60	5.2
Mechanical damage	45	9.2	26	3.9	71	6.2
Hydatid cyst	3	0.6	7	1	10	0.9
Abscess	7	1.4	19	2.9	26	2.3
Other causes	7	1.4	12	1.8	19	1.6
Overall	261	53.5	413	62.2	674	58.5

T. Jibat et al. Causes of abattoir condemnation in apparently healthy slaughtered sheep and goats at HELMEX abattoir, Debre Zeit, Ethiopia. *Revue Méd. Vét.*, 2008, 159, 5, 305-311.

Liver condemnation in goats

	Goats (n= 1536)					
	Young		Adult		Total	
	N	%	N	%	N	%
Fasciolosis	22	3.3	33	3.8	55	3.6
Cirrhosis	4	0.6	31	3.5	35	2.3
Hepatitis	13	2	47	5.4	60	3.9
Stelesia hepatica	76	11.5	110	12.5	186	12.1
Cysticercus tenuicollis	65	9.9	62	7.1	127	8.3
Calcifications	17	2.6	47	5.4	64	4.2
Mechanical damage	42	6.4	24	2.7	66	4.3
Hydatid cyst	6	0.9	21	2.4	27	1.7
Abscess	10	1.5	28	3.2	38	2.5
Other causes	4	0.6	11	12.5	15	0.9
Overall	259	39.3	414	47.2	673	43.8

T. Jibat et al. Causes of abattoir condemnation in apparently healthy slaughtered sheep and goats at HELMEX abattoir, Debre Zeit, Ethiopia. *Revue Méd. Vét.*, 2008, 159, 5, 305-311.

Lung condemnation in sheep

	Sheep (n=1152)					
	Young		Adult		Total	
	N	%	N	%	N	%
Pneumonia	132	27.3	191	28.8	323	28
Emphysema	33	6.8	46	6.9	79	6.9
Hydatid cyst	7	1.4	31	4.7	38	3.3
Abscess	5	1	21	3.2	26	2.3
Calcification	14	2.9	17	2.6	31	2.7
Others	5	1	11	1.6	16	1.4
Total	196	40.6	317	47.4	513	44.5

Lung condemnation in goats

	Goats (n=1536)					
	Young		Adult		Total	
	N	%	N	%	N	%
Pneumonia	122	18.5	284	32.4	406	26.4
Emphysema	34	5.2	72	8.6	106	6.9
Hydatid cyst	4	0.6	37	4.2	41	2.7
Abscess	7	1.1	25	2.9	32	2.1
Calcification	8	1.2	28	3.2	36	2.3
Others	9	1.4	10	1.1	19	1.9
Total	184	27.9	456	51.9	640	41.7

T. Jibat et al. Causes of abattoir condemnation in apparently healthy slaughtered sheep and goats at HELMEX abattoir, Debre Zeit, Ethiopia. *Revue Méd. Vét.*, 2008, 159, 5, 305-311.

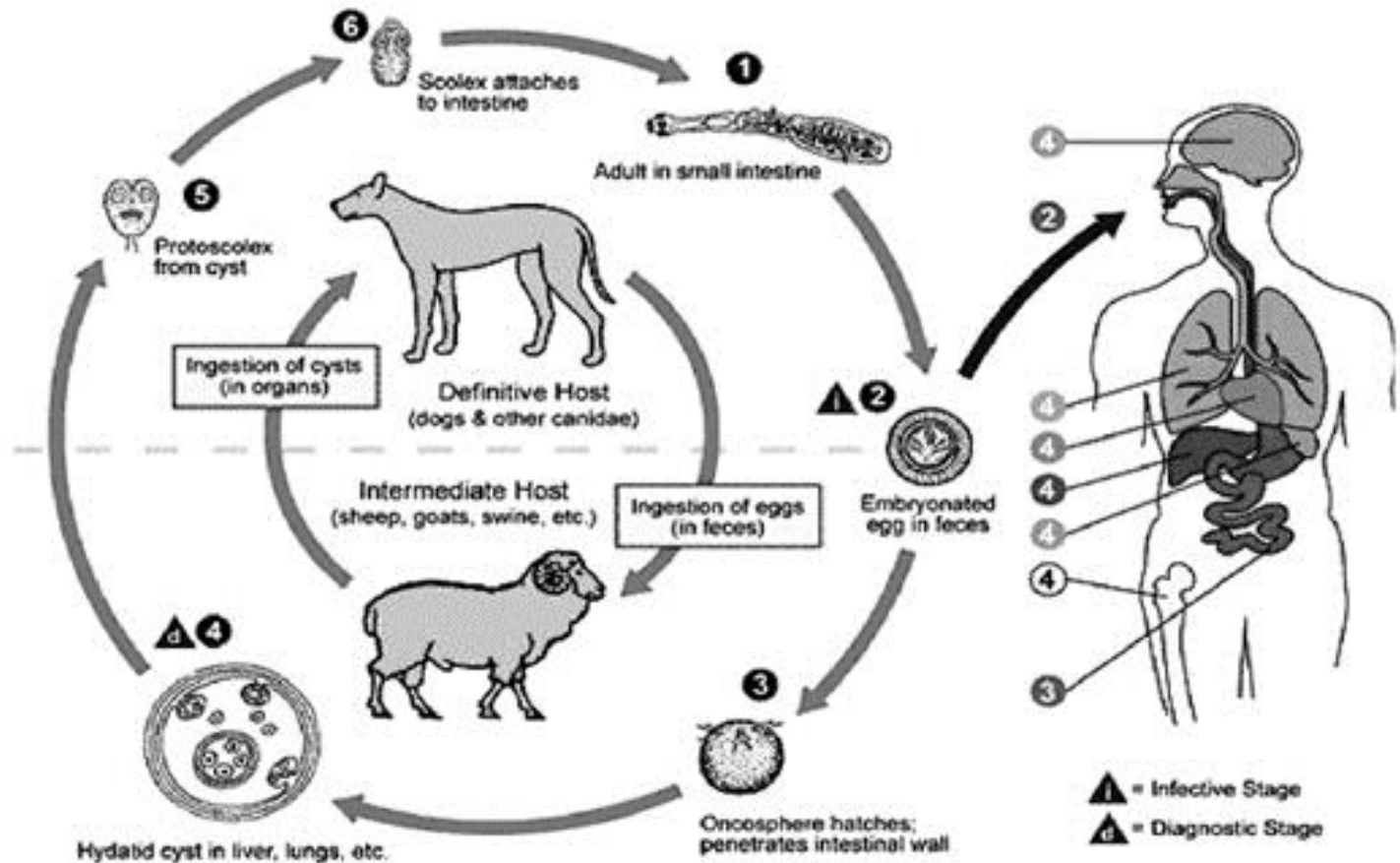
Larval tapeworm infections

- Adult form lives in dogs; larval forms in internal organs of sheep/goat
- *Taenia hydatigena* -*Cysticercus tenuicollis* (peritoneal cavity)
- *Taenia multiceps* –*Coenurus cerebralis* (brain)
- *Echinococcus granulosus* – hydatid cyst-zoonotic!

Larval tapeworm infections

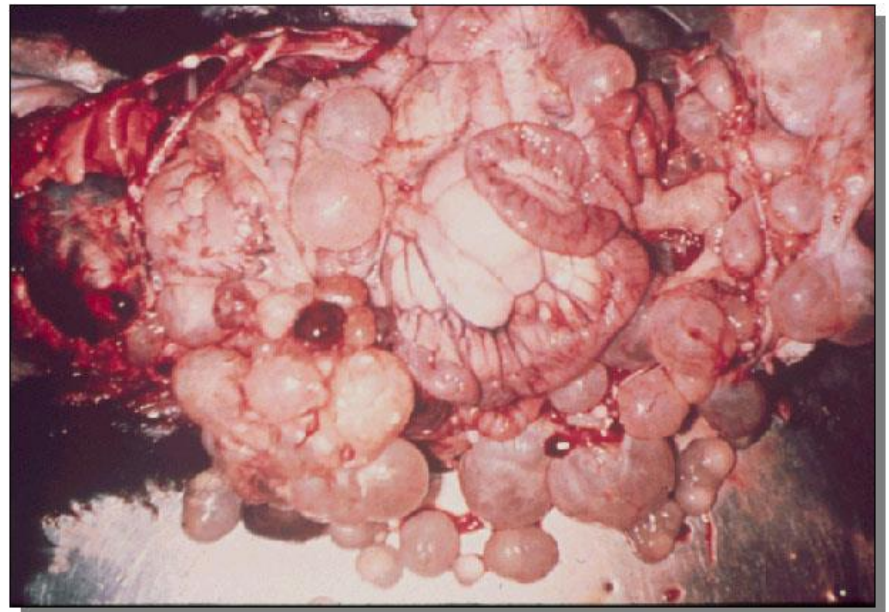
- Endemic in Ethiopian highland sheep population
- Lack of deworming of dogs
- Stray dogs and foxes have access to offal
- Freely roaming dogs on grazing land
- Dogs are fed sheep head and not dewormed
- Backyard slaughter of sheep

Hydatidosis



Hydatidosis

- *Echinococcus granulosus* – hydatid cyst cycle – zoonotic risk!
- Economic consequence: condemnation of carcasses



Coenurosis

- Coenurosis is fatal disease of sheep
 - *Coenurus cerebralis*=cystic larval stage of *Taenia multiceps* tapeworm
- Mature *Taenia multiceps* worm in small intestine of dogs, foxes (definitive host)
- Coenurus cysts develop in brain of intermediate hosts
 - Most often sheep; humans accidental hosts



Coenurosis clinical signs

- Circling, incoordination, dullness, head tilt, blindness, paralysis, separation from herd
- Course of disease is 35-45 days after clinical signs develop
- Correlation between cyst size and clinical signs



Coenurosis necropsy findings

- Pathological finding: necrosis of brain tissues around cyst, hemorrhage
- Cyst with scolices inside (hundreds)
- Cyst in cerebral hemisphere



Prevention of larval tapeworm infections

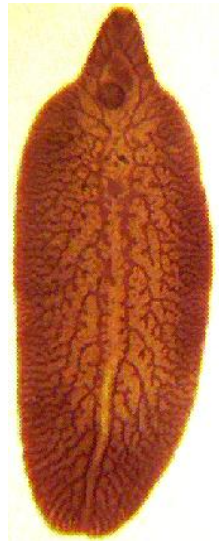
- Control tapeworm infection in dogs
- Prevent dogs from accessing sheep carcass
- Dispose of all sheep carcasses
- Even apparently sheep may have cysts therefore, disposing of all sheep carcasses is needed for control

Stilezia hepatica

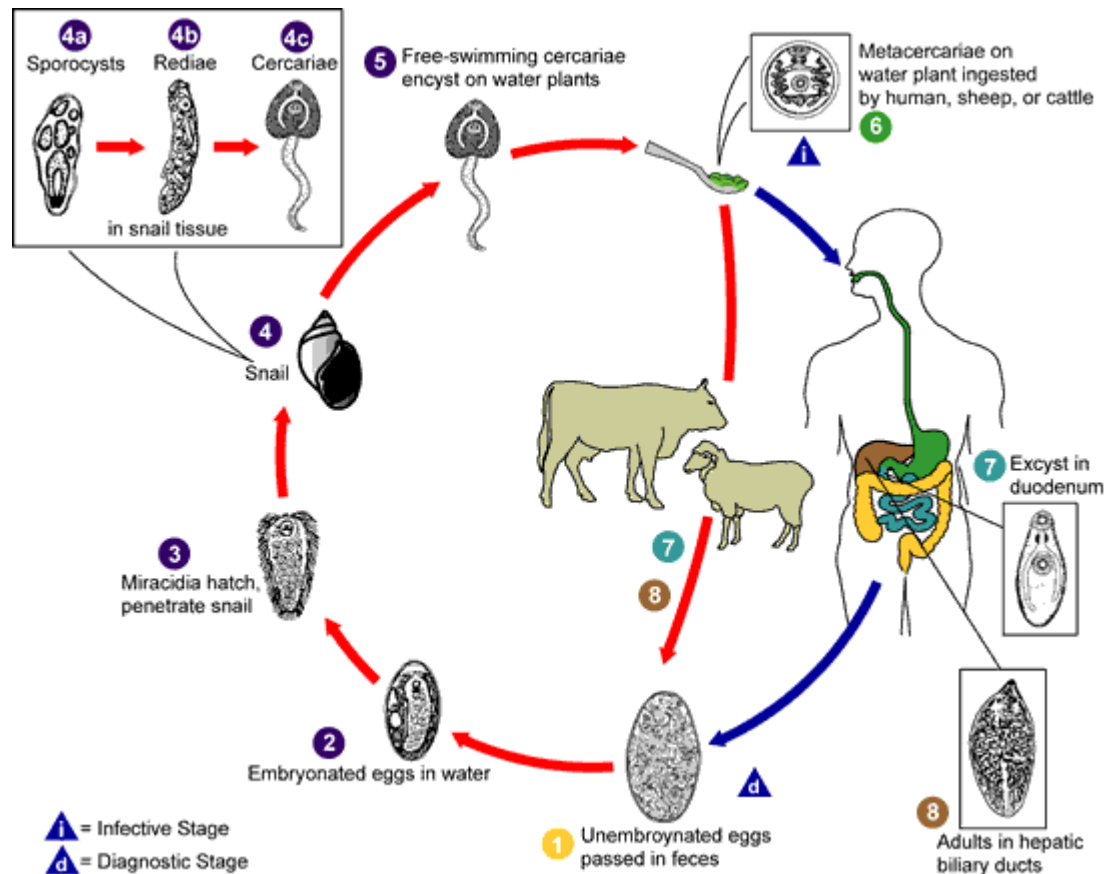
- *Stilesia hepatica* adult tapeworm, lives in bile duct of sheep and goat
 - Mites are suspected as intermediate host
- The symptoms of adult tape worms in sheep and goats may not be too obvious
- Economic loss due to liver condemnation

Fasciolosis

- *Fasciola hepatica* and *Fasciola gigantica*
 - In Ethiopia, *F. gigantica* is found at altitudes below 1800 m while *F. hepatica* is found at altitude between 1200-2560 m
- Adult flukes live in bile duct of cattle and sheep
- Lymnaeid snail is intermediate host
 - Along waterways, irrigation canals, swamps

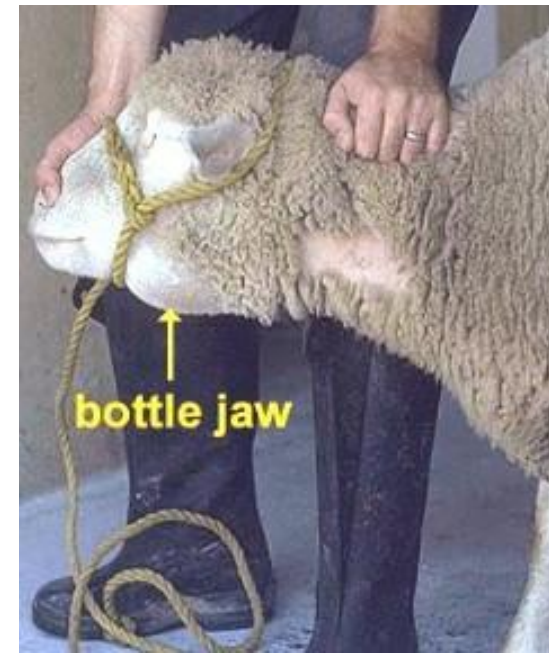


Fasciola life cycle



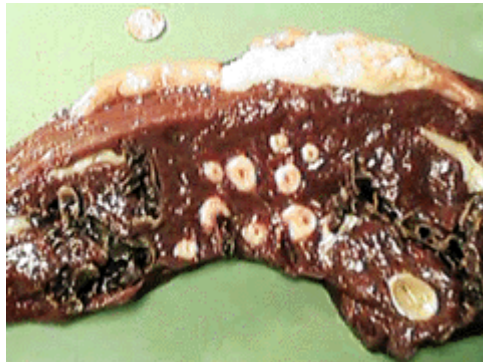
Fasciolosis- clinical signs

- Acute form: sudden death, abdominal pain, massive tissue damage due to migrating larvae
- Sub-acute form: anemia, jaundice, liver failure
- Chronic form: bile duct obstruction, hepatic fibrosis, anemia, bottle jaw



Fasciolosis diagnosis

- Tentative based on history and clinical signs
- Confirmation by demonstration of eggs by fecal examination
- Post-mortem: flukes in the liver



Fasciolosis control and prevention

- Reduction of snails on pastures
 - Chemicals, biological, drainage
- Strategic application of anthelmintics
- Grazing management
- In Ethiopia, the highlands contain pockets of waterlogged marshy areas. These provide suitable habitats year round for the snail intermediate hosts
-
- The prevalence of fasciolosis in arid and semi-arid areas is very low. In the presence of irrigation in semiarid and arid areas, the prevalence
- of fasciolosis is increasing

Black disease and Red Water

- Soil-borne Clostridial infections in conjunction with liver flukes
- Bacteria proliferate and produce toxins in damaged, necrotic liver tissue
- Black disease is caused by toxins of *Clostridium novyi* Type B
- Red Water disease is caused by toxins of *Clostridium haemolyticum*
- Field outbreaks are usually precipitated by invasion of the liver by immature liver fluke

Black disease and Red water

- The course of this disease is short and affected animals are usually found dead having shown no signs of illness
- Control is by annual vaccination of all breeding stock with a multivalent Clostridial vaccine



Haemonchosis

- Infection with *Haemonchus Contortus*, better known as the barber pole or wire worm
- Round worm (Nematode) that sucks blood in GI tract



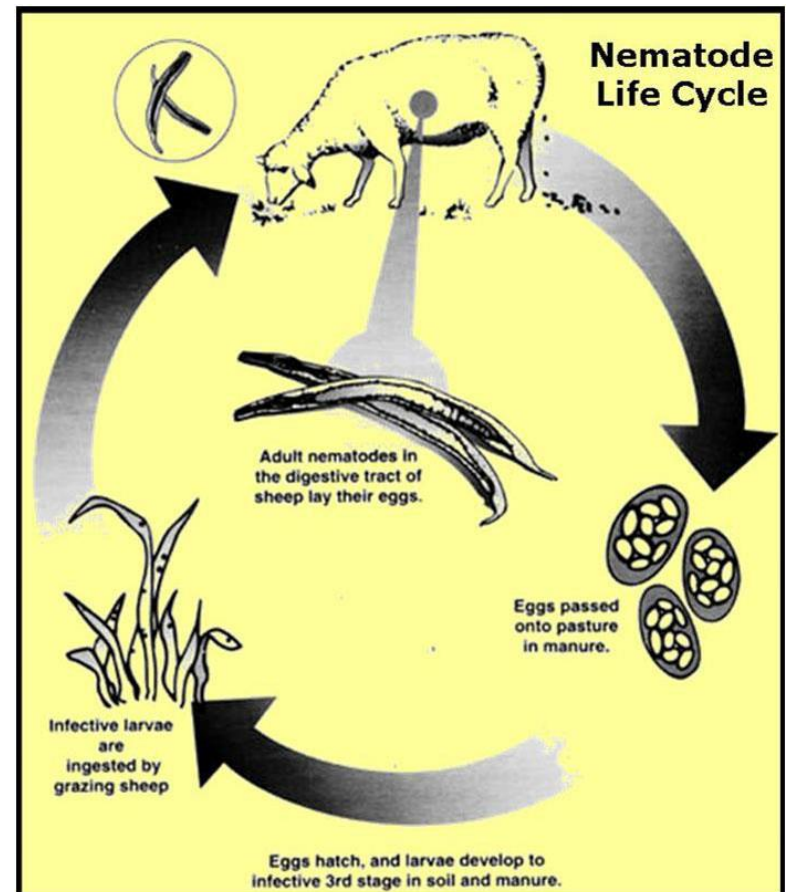
Haemonchosis

- The symptom is anemia, characterized by pale mucous membranes, especially in the lower eye lid; and bottle jaw, an accumulation (or swelling) of fluid under the jaw



Haemonchus life cycle

- Single-host parasites
- Adult worm lives in GI tract, eggs passed in feces



Ectoparasites

- Spend some or all of their life cycle on the skin of affected animals
 - As a general rule, those that spend entire life on animal are transmitted by direct contact
- May feed on the blood, epidermis or hair of affected animals
- Cause itching, affected animals often bite, scratch, and rub themselves
- Cause damage to skin and wool, reduce wool/hide quality, economic losses
- Skin damage allows secondary infections with bacteria

Ectoparasites

- Heavy infestations can considerably reduce the condition of the host and cause anemia
- May transmit diseases
- Diagnosis by visual inspection, skin scraping and microscopy
- Prevention by insecticide dips, sprays, pour-ons, powders etc

Ectoparasites in sheep

	Positive sheep (N=175)	
	N	%
Sheep ked (<i>Melophagus ovinus</i>)	57	32.6
<i>Damalinia ovis</i>	39	22.3
<i>Sarcoptes scabiei</i>	25	14.3
<i>Amblyomma</i>	22	12.6
<i>Ctenocephalides</i>	15	8.6
<i>Demodex</i>	12	6.6
<i>Linognathus africanus</i>	11	6.3

A. Tadesse et al. Study on the prevalence of ectoparasite infestation of ruminants in and around Kombolcha and damage to fresh goat pelts and wet blue (pickled) skin at Kombolcha Tannery, Northeastern Ethiopia. *Ethiop. Vet. J.*, 2011, 15(2), 87-101

Ectoparasites in goats

	Positive goats (N=66)
	N (%)
Sarcoptes scabiei	20(30.3)
Linognathus stenopsis	6(9.09)
Amblyomma	3(4.54)
Bovicola caprae	1(1.51)
Demodex caprae	1(1.51)
Ctenocephalides spp	1(1.51)

A. Tadesse et al. Study on the prevalence of ectoparasite infestation of ruminants in and around Kombolcha and damage to fresh goat pelts and wet blue (pickled) skin at Kombolcha Tannery, Northeastern Ethiopia. Ethiop. Vet. J., 2011, 15(2), 87-101

Ticks

Transmit diseases such as Anaplasmosis, Babesiosis, Nairobi sheep disease, Theileriosis



Sheep ked

- The sheep ked, *Melophagus ovinus* - wingless flies, such blood of sheep

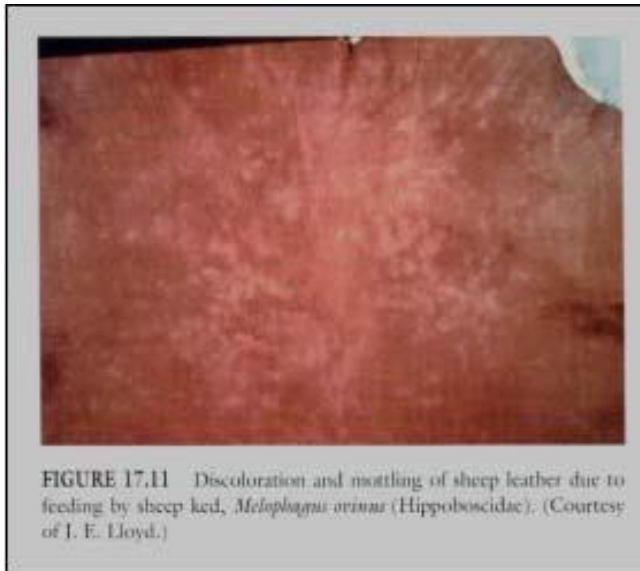


FIGURE 17.11 Discoloration and mottling of sheep leather due to feeding by sheep ked, *Melophagus ovinus* (Hippoboscidae). (Courtesy of J. E. Lloyd.)

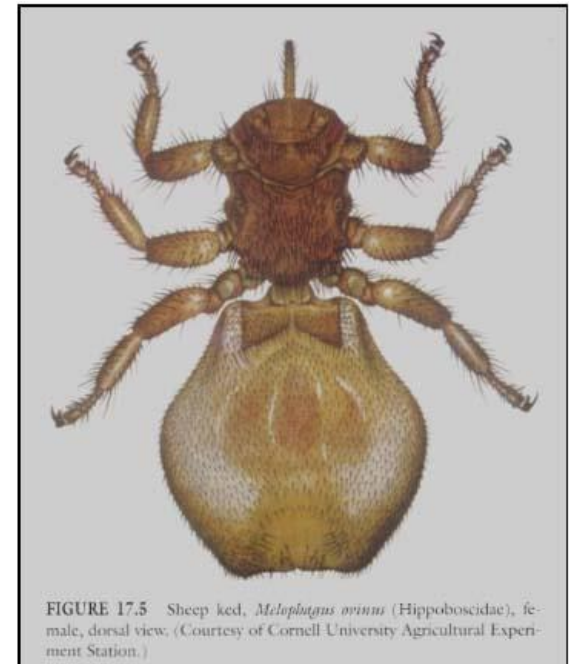


FIGURE 17.5 Sheep ked, *Melophagus ovinus* (Hippoboscidae), female, dorsal view. (Courtesy of Cornell University Agricultural Experiment Station.)

Sarcoptes scabiei

- The disease caused by these mites is called mange or scabies
- Animals with mange often have bald patches and secondary bacterial infections



Lice

- Lice are wingless insects with flattened bodies
- The sheep louse (*Bovicola ovis*) spends its entire life cycle on the sheep and causes damage to the wool



Demodicosis

- Demodectic mange, *Demodex* spp
- Mites invade hair follicles
- Causes small nodules on skin that may develop into abscesses

