



Zoonotic risks from small ruminants



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ABSTRACT

Zoonoses are infections that spread naturally between species (sometimes by a vector) from animals to other animal species or to humans or from humans to animals. Most of the zoonoses diagnosed in sheep and goats are transmitted by close contact of man with these animals and are, more often, occupational diseases that principally affect breeders, veterinarians and/or slaughterhouse workers. Some other diseases have an airborne transmission and affect the population in the vicinity of sheep/goat farms. Due to the fact that small ruminants are almost the only remaining animals which are migrating in industrialised countries, there is a severe risk for transmitting the diseases. Some other zoonotic diseases are foodborne diseases, which are mainly transmitted from animals to humans and to other animal species by contaminated food and water. Within the last decade central Europe was threatened by some new infections, e.g., bluetongue disease and schmallenberg disease, which although not of zoonotic interest, are caused by pathogens transmitted by vectors. Causal agents of both diseases have found highly effective indigenous vectors. In the future, climate change may possibly modify conditions for the vectors and influence their distribution and competence. By this, other vector-borne zoonotic infections may propagate into former disease free countries. Changes in human behaviour in consumption and processing of food, in animal housing and management may also influence future risks for zoonosis. Monitoring, prevention and control measures are proposed to limit further epidemics and to enable the containment of outbreaks. Measures depend mainly on the damage evoked or anticipated by the disease, the local situation, and the epidemiology of the zoonoses, the presence of the infective agent in wild and other animals, as well as the resistance of the causal microorganisms in the environment and the possibility to breed sheep and goats which are resistant to specific infections. In this review, the clinical signs in animals and humans of the main sheep and goat zoonoses, as well as the transmission route and the control measures are reported. Brucellosis, chlamydophilosis, Q fever, Orf, Rift valley fever and Bovine Spongiform Encephalopathy are described in greater detail, in order to determine factors that contribute to the choice of the control strategies.

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1. Introduction

Zoonoses are infectious diseases, which are transmitted from animals to humans (zooanthroponoses) and from humans to animals (anthropozoonoses). At least 71% of all human pathogens are zoonotic and about 75% of all emerging human pathogens over the past 10 years have been caused by pathogens originating from an animal or from products of animal origin (Wolfe et al., 2007; Rodolakis, 2014). Table 1 describes most microbial zoonotic diseases.

Small ruminants are important as source of infections for humans, a fact that has come under concern since the Q fever epidemic in the Netherlands from 2007 to 2010. The outbreak in humans occurred subsequently to the occurrence of Q fever in

large dairy goat farms. However, it has been known for a long time that small ruminants can be of importance in transmission of various other pathogens to humans, e.g., the agents of brucellosis, Orf, Rift valley fever. In this review, the clinical signs of the main sheep and goat zoonoses, as well as the transmission mode and the control measures are reported. Brucellosis, chlamydophilosis, Q fever, Orf, Rift Valley fever and Bovine Spongiform Encephalopathy, are described in greater detail, in order to determine factors that contribute to the choice of the control strategies.

2. Bacterial diseases

2.1. Brucellosis

Brucellosis is still an important zoonosis in the para-Mediterranean countries. It is also endemic in the Middle East, Western Asia, Africa and South America (Pappas et al., 2006). Northern and

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Table 1
Zoonotic diseases of small ruminants.

Disease	Agent	Small ruminants		Humans		Other animal species that can be infected	Control measures
		Clinical signs	Mode of transmission	Clinical signs	Mode of transmission		
Bacterial diseases							
Anthrax	<i>Bacillus anthracis</i>	Fever, lack of rumination, excitement or depression, pulmonary and pharyngeal oedema, uncoordinated movement, haemorrhagic discharge, swellings, sudden death	Consumption or breathing of bacterial spores	Cutaneous form (skin sore, developing into ulcer with black center), gastrointestinal form (fever, nausea, haemorrhagic diarrhea, loss of appetite, stomach pain), respiratory form (throat ache, coughing, tiredness, difficult breathing)	Direct contact with infected animals or contaminated animal products (e.g., handling infected animal carcasses or products, breathing bacterial spores, eating undercooked contaminated meat)	Numerous animal species	Vaccination of ruminants, restriction of animal movements, hygiene measures, collection of dead animals and sufficient heating in rendering plants, training of exposed people, antibiotic treatment
Brucellosis	<i>Brucella melitensis</i> , <i>B. abortus</i>	Late term abortion, stillbirth, orchitis, epididymitis, arthritis, fever, depression, weight loss, diarrhoea	Ingestion of contaminated material (e.g., feed, water, aborted material)	Undulant fever, arthritis, liver damage and miscarriages	Consumption of contaminated dairy products, breathing of contaminated dust, direct contact of open wounds with contaminated tissues, fluids, or surfaces	Cattle, horses, mules, donkeys, pigs	Vaccination, test and slaughter, training of people involved
<i>Campylobacter</i> infections	<i>Campylobacter fetus</i> subsp. <i>intestinalis</i> , <i>C. jejuni</i>	Sheep: abortion, stillbirth, birth of weak lambs, increased neonatal mortality; goats: asymptomatic infections in adults, diarrhoea, fever, arthritis in kids	Oral infection through contaminated forages or water	Intestinal inflammation (diarrhoea, abdominal pain, fever, nausea, vomiting), arthritis, convulsions and meningitis, abortion, endocarditis	Oral infection through consumption of contaminated food or water, handling of infected females during parturition	Pigs, poultry	Training of exposed people, hygiene measures, antibiotic treatment
Caseous lymphadenitis	<i>Corynebacterium pseudotuberculosis</i>	Abscesses in lymph nodes, progressive weight loss	Contact with contaminated material, consumption of contaminated forages, at sucking (lambs/kids)	Painful skin wounds with purulent material and necrosis, abscessation of lymph nodes	Direct skin contact with contaminated material	Horses, pigs, Camels.	Vaccination, test and slaughter, training of exposed people
<i>Chlamydophila</i> infection	<i>Chlamydophila abortus</i>	Late term abortion, retained foetal membranes, stillbirths, epididymitis, pneumonia, conjunctivitis	Contact with infected pregnant ewes/does at lambing/aborting process/post-partum, through contaminated bedding/waste, inhalation of contaminated dust	Flu-like signs with headache, chills, fever, joint pain, light sensitivity, vomiting, sore throat, pneumonitis; abortion	Consumption of contaminated food or water, inhalation of contaminated dust, contact with contaminated animal material	Cattle	Vaccination of ewes and does, training of exposed people

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