Preventive Veterinary Medicine 130 (2016) 67–76

Contents lists available at ScienceDirect

Preventive Veterinary Medicine

journal homepage: www.elsevier.com/locate/prevetmed

Incidence and economic impact of rabies in the cattle population of Ethiopia

Tariku Jibat[a,b,*], Monique C.M. Mourits[a], Henk Hogeveen[a,c]

[a] Business Economics Group, Wageningen University, Hollandseweg 1, 6706 KN, Wageningen, The Netherlands
[b] College of Veterinary Medicine and Agriculture, Addis Ababa University, Debre Zeit, Ethiopia,
[c] Department Farm Animal Health, Faculty of Veterinary Medicine, Utrecht University, Utrecht, The Netherlands

ARTICLE INFO

Article history:
Received 11 December 2015
Received in revised form 26 May 2016
Accepted 8 June 2016

Keywords:
Cattle
Economic impact
Ethiopia
Livestock
Rabies
Subsistence

ABSTRACT

Rabies is a viral disease that can cause fatal encephalomyelitis both in animals and humans. Although incidences of the disease in cattle have been reported, insight in the economic impact of the disease in livestock remains limited. By affecting cattle in subsistence systems, rabies may have extensive economic impacts at household and country levels, in addition to the effects on human health. This study presents estimates of the direct economic impact of rabies at herd level in two representative subsistence cattle-farming systems in Ethiopia, the mixed crop-livestock and pastoral production systems. The economic impacts were assessed by a structured questionnaire administered to 532 cattle-owning households. These households were selected from four districts within two administrative zones; each zone representing a cattle production system. Rabies incidence rates of 21% and 11% at herd level were calculated for the mixed crop-livestock and pastoral production systems, respectively. The incidence rate at cattle level was the same in both systems., i.e. 2%. Herd-level incidence rates were higher in the mixed crop-livestock system than in the pastoral system ($P < 0.05$). Average economic losses per herd due to rabies were estimated at 49 USD per year for the mixed-crop livestock system, and at 52 USD per year for the pastoral system; whereas in affected herds the average losses per year were 228 USD (range 48–1016 USD) in the mixed crop-livestock system, and 477 USD (range 173–1140 USD) in the pastoral system. The average herd-level economic losses were not significantly different between the farming systems; however once the herd was affected, the losses were significantly higher for the pastoral system than for the mixed crop-livestock system ($P < 0.01$). The losses due to rabies in cattle are relatively high for pastoral households, due to their complete dependency on livestock for their livelihoods. Although the current estimates only account for the direct losses resulting from cattle mortality, the estimates already indicate the potential economic gains from a rabies intervention in the dog population, of which the benefits can be shared by the public health sector.

1. Introduction

Rabies is a viral disease that causes fatal encephalomyelitis in animals and humans (Wunner and Conzelmann, 2013). A recent global estimate indicates that rabies is annually responsible for 60,000 human death cases (Hampson et al., 2015). Most of these cases occur in Asian and African countries (Knobel et al., 2005; Hampson et al., 2015), where domestic dogs are the main transmitters of the rabies virus (Knobel et al., 2005).

In Africa, rabies has also been reported as a potential problem for cattle production in free-range production systems, such as the mixed crop-livestock and pastoral production systems. In these systems dogs are kept in close contact with cattle (Sillero-Zubiri and Switzer, 2004), providing an opportunity to transmit the virus to cattle through a bite of an infected dog. By affecting cattle in subsistence systems, rabies may have extensive economic impacts at the household and country levels, in addition to the effects on human health (Okell et al., 2013). Rabies in cattle causes direct losses due to mortality and reduced milk yield. It affects the livelihoods of people through lower food security, due to the loss of protein resources and draught power (Tambi et al., 2006). Worldwide, only a few studies have estimated the economic impact of rabies in livestock (Hampson et al., 2015). These estimates were made at the

* Corresponding author at: Addis Ababa University, College of Veterinary Medicine and Agriculture, Debre zeit, Ethiopia.
E-mail addresses: tariku.beyene@wur.nl, jibattariku@gmail.com (T. Jibat).

http://dx.doi.org/10.1016/j.prevetmed.2016.06.005
0167-5877/

aggregated level of continent or region and did not explain the impact at individual country level.

A large dog population size in combination with poor dog management has resulted in a high endemicity of canine rabies in Ethiopia, accounting for an estimated death rate of 10,000 people a year (Jemberu et al., 2013). In Ethiopia many households own dogs usually for herding livestock or guarding property. Statistics on the dog population size is lacking, but a conservative estimation indicates an average of one owned dog per five households (Deressa et al., 2010). Available studies on the incidence of rabies in the dog population indicate rates as high as 413 cases per 100,000 in dogs (Jemberu et al., 2013). Currently, there is no official rabies control program in Ethiopia. Dog vaccination coverage is very low due to the limited availability of vaccines, lack of awareness, and the perception of high vaccination costs (Ali et al., 2010; Jibat et al., 2015).

With 57 million heads of cattle, Ethiopia owns the largest cattle population in Africa (CSA, 2012). Occurrence of rabies in cattle has been reported in central and northern parts of the country (Ali et al., 2010; Jemberu et al., 2013). As the livestock sector in Ethiopia provides livelihoods to 65% of the human population (Solomon, 2003) occurrence of rabies in cattle can have serious economic consequences. Accurate information on the incidences of rabies in humans, dogs and livestock is, however, scarce in Ethiopia (Jemberu et al., 2013), due to the absence of proper registration systems. Rabies-related medical and veterinary records are incomplete and cannot be used for a proper quantification of the impact of rabies (Tefera et al., 2002; Adane et al., 2013; EHNRI, 2012; Randall et al., 2004).

Representative information on the economic impact of rabies in livestock needs, therefore, to be collected from livestock owners directly, using participatory and conventional survey approaches. Quantitative information on the impact of rabies in livestock can support decisions about rabies control and strengthen the justification for the implementation of a one-health approach to fight diseases in resource-limited countries, such as Ethiopia (Zinsstag et al., 2011). In this study, we aim to assess the direct economic impact of rabies in cattle in the subsistence oriented farming systems of Ethiopia, using representative and quantitative data obtained through participatory and conventional survey approaches.

2. Material and methods

2.1. Study site selection

In Ethiopia, cattle production takes primarily place in subsistence farming systems, i.e. the mixed crop-livestock system and the pastoral system (Tolera and Abebe, 2007; Alemayehu, 2011). The mixed crop-livestock system prevails in the central highland parts of the country and accounts for about 80–85% of the cattle population (MOARD, 2007). In this system, cattle provide draft power for the crop production as well as manure for fertilizer and cooking fuel, and meat and milk for household consumption. The pastoral system is practised in the arid and semiarid peripheral parts of the country and accounts for 15–20% of the population (MOARD, 2007). In this system, cattle farming is the main livelihood providing farm cash income as well as food for subsistence.

The study was conducted in the administrative zones of Arsi and Borena (Fig. 1). These zones were selected for their representation of the two subsistence farming systems. Arsi represents the mixed crop-livestock production system and is located in the central highlands about 150 km east of Addis Ababa. People in this zone live predominantly from crop production. Borena represents the pastoral production system and is located in the southern lowlands about 600 km south of Addis Ababa. This zone predominantly produces livestock, as crop production is not feasible given the shortage of rainfall throughout the year.

2.2. Study design

A multistage cluster sampling technique was used to select representative districts and villages from both zones. Selection for the first cluster (district level) was done purposely by selecting the districts with the largest livestock populations. For Arsi these districts were Munessa (population size = 242,400) and Lemuna-Bilbilo (population size = 232,949), for Borena these districts were Yabelo (population size = 232,949) and Dugda Dawa. (population size = 294,202). Selection for the next cluster (village) was done randomly within the district. Five villages per district were chosen based on a pragmatic consideration of logistic feasibility. Accordingly, 20 villages were selected in total, resulting in a sample size of 532 livestock-owning households; 248 in the mixed crop-livestock system and 284 in the pastoral system.

2.2.1. General setup

We first performed a preliminary exploration using a participatory approach, because of uncertainty about the presence of rabies in the selected areas and about the ability of livestock owners to identify the disease among their livestock. The preliminary exploration was undertaken by means of a group discussion with elder livestock owners in each of the 20 selected villages. This was followed by interviews with all livestock-owning households (N = 532) in the selected villages, using a structured questionnaire to collect data to assess the direct economic impact of rabies in the mixed crop-livestock and pastoral systems.

2.2.2. Preliminary exploration of rabies in cattle

In each of the selected villages, we asked the village administrators to identify 15 elder livestock owners who had lived in the village for more than 20 years and were older than 50 years of age. We approached these elders to participate in a group discussion on zoonotic diseases. As a group size of 10 participants is accepted practice in participatory appraisal (Catley et al., 2002), the group discussions were joined by 10–12 livestock owners in each of the selected villages.

The group discussion was conducted in the local language (Oromifa), which all participants understood. Local facilitators were available to communicate in other local languages if needed, to ensure equal understanding. The discussions were recorded using a voice recorder and transcribed at a later date.

Each group was asked to identify and list the local names of zoonotic diseases that are transmitted to cattle and humans and which have occurred in their area recently during the past five years. Neither the livestock owners nor the local facilitators were informed that the main disease of interest was rabies, to minimise response bias. The group discussions were structured so that participants could easily share their opinions with the group, in an environment that encouraged everyone's participation to reach a final consensus on the list of zoonotic diseases (Catley et al., 2002).

Once the participants had listed the local names of recently (during the past five years) occurring zoonotic diseases, they were asked to describe the clinical signs of these diseases in cattle, which they either knew or had experienced. Subsequently, the group was asked to rank these diseases according to five criteria, using the procedure described by (Okell et al., 2013). The criteria were: 1) the perceived risk of the disease in terms of susceptibility and severity to human health, 2) the perceived possibility to treat and 3) prevent the disease in cattle, 4) the perceived mortality rate in cattle, and 5) the perceived morbidity rate in cattle. To identify the English name of each disease, we compared the description of clinical signs given by