Acta Tropica 167 (2017) 79–85

Contents lists available at ScienceDirect

Acta Tropica

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

Bovine trypanosomosis and vector density in Omo-Ghibe tsetse belt, South Ethiopia

Rahmeto Abebe*, Solomon Gute, Ijigu Simon

School of Veterinary Medicine, Hawassa University, P.O. Box 05, Hawassa, Ethiopia

ARTICLE INFO

Article history:
Received 19 August 2016
Received in revised form 7 December 2016
Accepted 15 December 2016
Available online 19 December 2016

Keywords:
Bovine
Omo-Ghibe
Prevalence
Risk factors
Trypanosomosis
Vector density

ABSTRACT

African animal trypanosomosis (AAT) is a parasitic disease that causes serious economic losses in livestock from anemia, loss of condition, emaciation and death in untreated cases. It is one of the major constraints to improved livestock production and productivity in Ethiopia. Entomological and parasitological surveys were conducted in the Omo-Ghibe tsetse belt of south Ethiopia to estimate the prevalence of bovine trypanosomosis and the apparent tsetse density (AD), and identify the potential risk factors. For the parasitological study, blood samples were collected from 1508 cattle sampled from 11 districts and assayed using the buffy coat technique and Giemsa-stained thin smears. For the entomological survey, a total of 216 biconical and NGU traps were deployed in all districts. The overall animal-level prevalence of trypanosomosis was 7.8% (95% CI: 6.5, 9.3). The trypanosome species identified were *Trypanosoma congolense* (75.4%), *T. vivax* (20.3%), *T. brucei brucei* (1.7%) and mixed *T. congolense/T. vivax* (2.6%). Regarding the entomological survey result, a total of 2243 tsetse flies were captured which identified to be *Glossina pallidipes* (85.1%) and *G. f. fuscipes* (14.9%). Besides, other biting flies of the genus *Stomoxys* (n = 146) and *Tabanus* (n = 17) were also trapped. The AD noted in the present study was 3.5 flies/trap/day. Both the prevalence of trypanosomosis and AD of tsetse flies were significantly ($p < 0.05$) influenced by altitude. The prevalence of trypanosomosis was also significantly ($p < 0.05$) associated with poor body condition score, black coat color and lower mean packed cell volume while no significant prevalence difference was noted along with age and sex category. In conclusion, the present study suggested that trypanosomosis is an important disease of cattle in the Omo-Ghibe tsetse belt in dry season. The disease is mainly caused by the most pathogenic *T. congolense* and transmission is predominantly by tsetse flies, particularly *G. pallidipes*. The study warrants the need for strengthening the vector and parasite control interventions in the area.

1. Introduction

Bovine trypanosomosis is a disease complex caused by several species of protozoan parasites of the genus *Trypanosoma*, mainly transmitted cyclically by the genus *Glossina* (tsetse flies), but also transmitted mechanically by several biting flies. Tsetse infests 10 million square kilometers and affects 37 countries, mostly in Africa, where the disease is known as 'nagana'. The disease can affect various species of mammals but, from an economic point of view, tsetse-transmitted trypanosomosis, is particularly important in cattle. It is mainly caused by *Trypanosoma congolense, T. vivax* and, to a lesser extent, *T. brucei brucei.* Infection of cattle by one or more of the three trypanosomes results in subacute, acute, or chronic disease characterized by intermittent fever, anemia, rapid loss of condition, emaciation, collapse and death in untreated cases (Steverding, 2008; OIE, 2013).

Tsetse-transmitted trypanosomosis is one of the major impediments to improved livestock production and productivity in Ethiopia. The disease is widely distributed across the tsetse-infested belts found in the western and southern regions of the country, where approximately 14.8 million cattle and a considerable number of other domestic animals are estimated to be at risk of infection over an area of about 220,000 km^2 (MoARD, 2004). As agriculture is largely dependent on draught power, tsetse transmitted animal trypanosomosis is also a major constraint to utilization of the large land resources in these regions for crop production (Abebe, 2005).

To date five species of *Glossina* namely *G. morsitans submorsitans*, *G. pallidipes*, *G. fuscipes fuscipes*, *G. tachinoides*, and *G. longipennis* are known to exist in Ethiopia. These vectors cyclically transmit four

* Corresponding author.
E-mail address: rahmetoabe@gmail.com (R. Abebe).

http://dx.doi.org/10.1016/j.actatropica.2016.12.016
0001-706X/

species of trypanosomes (*T. congolense*, *T. vivax*, *T. brucei brucei* of livestock and *T. rhodesiense* of human) (Langridge, 1976).

Over the past few decades, various efforts have been made to control tsetse and trypanosomosis in Ethiopia through coordinated action of the local community, government and non-governmental organizations. Tsetse and trypanosomosis control interventions commonly used in Ethiopia include insecticidal pour-on, insecticide impregnated traps and targets, and use of trypanocidal drugs. In spite of all these efforts, reports from different parts of the country indicate that the disease is still a major threat for livestock production. According to the most recent published studies, bovine trypanosomosis prevalence estimate falls within the range of 7.2 and 23% (Ayele et al., 2012; Tafese et al., 2012; Lelisa et al., 2014; Duguma et al., 2015; Leta et al., 2016; Sheferawa et al., 2016). Despite the existence of several studies on trypanosomosis and its vectors in the country, most of the studies were restricted to only a small study area and involved a sample size of not more than 400 cattle. Given the huge economic burden of the disease, a comprehensive study covering wider study area and large sample size is of paramount importance to generate accurate information about the disease, vectors and the success of the existing control interventions, and inform the concerned government authorities what to do in the future. There is also paucity of up-to-date information about the disease in the present study area.

This study was therefore, designed to estimate the prevalence of bovine trypanosomosis and apparent density of tsetse flies, and identify the potential risk factors with special emphasis on agro-ecological conditions.

2. Material and methods

2.1. Study area

The study was conducted in the part of Omo-Ghibe tsetse belt located in Southern Nations, Nationalities and Peoples Regional State (SNNPRS). Out of 64 districts found in the study area, 11 were selected purposively for both parasitological and entomological studies based on the frequency of trypanosomosis case records obtained from district veterinary clinics and also opinion of farmers. The study districts were located between 5°80′ −7°99′N latitude and 36°49′–37° 73′E longitudes (Fig. 1). The altitude of the entomological study areas ranged between 930 and 1767 m above sea level (m.a.s.l) while blood samples for parasitological study were collected from 1007 to 1934 m.a.s.l elevations.

2.2. Study animals and production system

Cattle production system in the study areas is characterized by mixed farming system, where crops and livestock production practiced hand in hand. The cattle herds in the area are predominantly indigenous zebu breeds that are largely dependent on grazing on naturally persistent pastures but supplemented by crop residues during the dry seasons. Cattle are kept mainly for milk production, draught power and manure.

2.3. Study design and sampling

The study was conducted in a dry season between November 2013 and March 2014. A cross-sectional study design was followed to estimate the prevalence of trypanosomosis and vector density. The sample size for parasitological study was determined following the method described by Thrusfield (2005) for simple random sampling with 95% confidence level and 5% absolute precision, considering 10% expected herd prevalence obtained by a previous dry season study (Dagnachew et al., 2005). In this study, a "herd" was defined as cattle grazing on the same communal grazing land which could either be from different households or different kebeles. A "kebele" is the smallest administrative unit in Ethiopia. The grazing areas ("herds") found in the selected districts were identified by the help of community animal health workers assigned there. Accordingly as per the predetermined parameters, the minimum computed sample size was 138 cattle "herds" and, herd samples were proportionally allocated for 11 districts based on their respective cattle population. Consequently, sampling frame of communal grazing areas ("herds") was prepared in each district and 10% of the "herds" were randomly picked for the study in a lottery method. In each grazing area (herd) a minimum of 10% of cattle were picked systematically. Eventually a total of 1508 animals were included in the study.

2.4. Entomological survey

For the entomological survey, a total of 216 biconical and NGU traps were deployed in the 26 kebeles as described by FAO (1992). Acetone and cow urine were used as a bait to attract flies. The traps were deployed at an interval of about 200 m apart and remained at one site for 72 h. All trap sites were geo-referenced using hand held global positioning system (GPS) units. Tsetse and other biting flies trapped were collected and counted. Tsetse flies were identified to the species level based on their characteristic morphological features (FAO, 1992). The number of tsetse flies captured per trap per day (FTD) was computed to estimate the overall and district level apparent tsetse density.

2.5. Parasitological study

Blood samples were collected from marginal ear vein of each animal in heparinized capillary tubes, which were sealed at one end with bee wax. The capillary tubes were then transferred to a haematocrit centrifuge and centrifuged at 12,000 rpm for 5 min. The packed cell volume (PCV) was measured using a haematocrit reader for determination of the level of anemia. The capillary tubes were then cut using a diamond tipped pen 1 mm below the buffy coat to include the upper most layers of the red blood cells and 3 mm above to include the plasma. The content was expressed on to a clean microscopic slide, mixed well and covered with a 22 × 22 mm cover slip. Then the wet smear was examined by 40 x objective lens for the presence of motile trypanosomes (Woo, 1970). Confirmation of trypanosome species was done by examination of Giemsa stained thin smears at 100 x magnification (Luckins, 1992).

2.6. Data analysis

Data collected from both parasitological and entomological studies were coded and entered in to a Microsoft Excel Spreadsheet. All statistical analyses were performed using STATA statistical software version 11 (StataCorp, 4905 Lakeway Drive, College Station, Texas) using survey command. Prevalence was estimated as the proportion of trypanosome positive animals over examined. The association of trypanosomosis (dependent variable) with different independent variables (age, sex, body condition score (BCS), coat color, and altitude) was analyzed by using univariable logistic regression analysis. Predictors with liberal P value ($p < 0.25$) were subjected to multicolinearity assessment and those covariates whose kruskal gama values ranged between −6 and +6 were considered for multivariable logistic regression analysis. The final model was developed in stepwise backward exclusion method using log-likelihood and wald statistics. Model fit and validity were checked in Hosmer and Lemeshow statistics and Receiver Operating Curve (ROC), respectively (Dohoo et al., 2009). The difference in mean PCV% between trypanosome infected and non-infected ani-