Parasitological prevalence of bovine trypanosomosis in Kindo Koisha district, Wollaita zone, south Ethiopia

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ABSTRACT

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A cross sectional survey to determine the distribution and prevalence of trypanosomosis was conducted in Kindo Koisha district, in the Wollaita zone in southern Ethiopia. A total of 1 008 adult cattle was examined at eight different localities. Dark field examination of the buffy coat, as well as stained thin blood film examination and packed cell volume (PCV) evaluation were the diagnostic techniques used.

The overall prevalence of bovine trypanosomosis was 15 %. Among the positive animals, 108 (71.1 %), 43 (28.4 %) and 1 (0.6 %) were due to *Trypanosoma vivax*, *Trypanosoma congolense* and mixed infection (*T. vivax* and *T. congolense*), respectively.

The infection rate of *T. vivax* and *T. congolense* varied significantly ($P < 0.01$).

The mean PCV of the positive and negative animals ranged between 18.3–32.1 % and 26.8–33.4 %, respectively. The mean PCV of negative animals (28 %) was significantly higher than the mean PCV of positive animals (22.3 %) ($P < 0.001$). There was an inverse association of PCV with the prevalence of trypanosomosis ($P > 0.05$). The herd average PCV values of each site decreased with increasing proportion of the positive herds of that particular site.

Of the diagnostic tests employed, the microhaematocrit buffy coat technique is relatively sensitive and it has an added advantage of indicating the general condition of the animal by haematocrit measurement.

In view of the risk of trypanosomosis, a control intervention through the strategic application of appropriate trypanocidal drugs is recommended. A tsetse fly control scheme to reduce host-tsetse fly contact is equally as important as chemotherapy and chemoprophylaxis against trypanosomosis.

Keywords: Cattle, Ethiopia, prevalence, *Trypanosoma congolense*, *Trypanosoma vivax*

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INTRODUCTION

Trypanosomosis is one of the most important infectious diseases of livestock in Africa and hampers agricultural production in many sub-Saharan countries including Ethiopia. The effects of trypanosomosis are due not only the direct losses resulting from mortality, morbidity and infertility of infected animals and the costs of controlling the disease but also to the indirect losses, which include the exclusion of livestock and animal power-based crop pro-

duction from the extensive tsetse flies (*Glossina* spp.) infested areas (FAO 1987). Reduction of crop production in the overstocked and degraded highlands of Ethiopia is brought about by the presence of tsetse and trypanosomosis in the lowlands, which has resulted in a shift of the human population and their animals to the highlands (Slingenbergh 1992).

In a survey of tsetse flies and trypanosomes in Ethiopia, six *Glossina* species and four *Trypanosoma* spp. have been recorded and their distributions mapped (Balis & Bergeon 1970; Langridge 1976). The majority of the vectors and the parasites are found in the southern and western part of the country. Furthermore, fly progress has been recorded in the lower Rift Valley and in the Omo River region (Balis & Bergeon 1970; McConnel & Baker 1974; Fuller 1978).

A large portion of the southern part of Ethiopia is currently infested by tsetse flies and livestock are therefore at risk of trypanosomosis (Itty, Swallow, Rowlands, Woudyalew & d'Ieteren 1995; Kidane-mariam, Hadgu & Sahle 2000).

Among the existing disease problems, trypanosomosis, known colloquially as Gendi, is considered as the major livestock production constraint in the area. Trypansomosis and its associated problems are reported to be very serious in the area in which the present study was conducted (Anon. 1996).

Before embarking on control or an intervention scheme, epidemiological surveys need to be undertaken to determine the extent of the problem using available diagnostic methods (Luckins 1988). The present study was undertaken with the main objectives of determining the prevalence of trypanosomosis and identifying the species of trypanosomes infecting cattle as a benchmark to instigate strategic control interventions.

MATERIALS AND METHODS

Study area

The study area, Kindo Koisha district, is located in the Wollaita administrative zone, south Ethiopia, between 6–7°N, 37–38°E. Most study villages are located at the edge of the Omo River valley.

The altitude ranges between 700–1 900 m above sea level. There are two rainy seasons, a short rainy period (February to mid-April) and the long rainy seasons (June to September), with an average annual precipitation of 950 mm.

Experimental design

A stratified sampling strategy was used which involved the random selection of eight locations (Table 1) after the entire peasant associations (PA) of the district had been stratified into three geographical zones (high-, mid- and lowlands) based on their altitude and climate.

From each stratum two locations were selected randomly and two more were added to the lowland eco-zone as a contingency for the large proportion of cattle that are kept there and the vastness of the area. Therefore 1 008 cattle were sampled from a population of 78 325 in the district.

Sample size was calculated by the method described by Thrusfield (1986) to provide 95 % confidence and 5 % certainty at expected prevalence of 50 %. To avoid sampling bias when dealing with non-contagious disease, a two to three times increase in the sample size would be appropriate (Leech & Sellers 1979). Therefore, in the present study, the sample size was doubled (Table 1).

Sample collection and diagnostic techniques

Examination of the buffy coat and stained thin blood films were the diagnostic tests used.

Thin blood films were prepared from a drop of blood obtained by venepuncture of visible ear veins using a lancet. Blood films were fixed on site with methanol and stained with 10 % Giemsa solution at the laboratory.

Whole blood was evacuated at the same time from the ear veins using heparinized capillary tubes. The capillary tubes were sealed with 'Cristaseal' and centrifuged on site in a microhaematocrit centrifuge for 5 min at 1 200 rpm. A portable diesel generator of 6.5 kV was used as a power source in the field. After centrifugation packed cell volume (PCV) of each sample was determined. Animals with PCV readings below 24 % were considered as anaemic (Kelly 1967). The haematocrit tubes were cut a few millimetres below the junction of the buffy coat/plasma levels, and the erythrocytes, buffy coat and plasma of each specimen was expressed onto a microscope slide and examined using dark-ground microscopic technique with a 40X objective lens.

When the sample was found positive for a trypanosome, a thin smear was prepared, fixed, stained with Giemsa and examined with the 100X (oil immersion) objective lens for species identification.

RESULTS

Parasitological prevalence

A total of 1 008 cattle were examined. Trypanosomes were detected in 152 cattle (15%). The trypanosome species involved were *T. vivax*, (71%), *T. congolense* (28.4%) and mixed, *T. vivax* and *T. congolense* (0.6%). The prevalence of trypanosomosis varied among sampling sites (Table 1). The highest was recorded in Mundena (20.7%) and the lowest in Soreto (4.7%). The proportion of *T. vivax* infection was higher in Dedekere (83.3%), Mundena (82.3 %) and Borkoshie (82.3 %), while T. *congolense* infection was proportionally high in Hanze (50 %), Molticho (38.8 %), Zamine Nare (35.3 %) and Soreto (33.3%). In almost all survey areas, except

Hanaze, the infection rate of *T. vivax* was significantly higher than *T. congolense* ($P < 0.01$).

PCV

The mean PCV of positive and negative animals ranged between 18.3–32.1 % and 26–33.4 %, respectively (Table 1, Fig.1 and 2). The mean PCV of negative animals (28 %) was significantly higher than the average PCV of positive animals (22.3 %) ($P < 0.001$). Only 74.4 % (113/152) of positive animals revealed PCV readings of less than 26% while 25.6 % (39/152) of positive animals showed PCV readings of higher than 28%. One hundred and thirty two animals (15.6%) with PCV readings of below 24 % were negative for trypanosomes. A negative
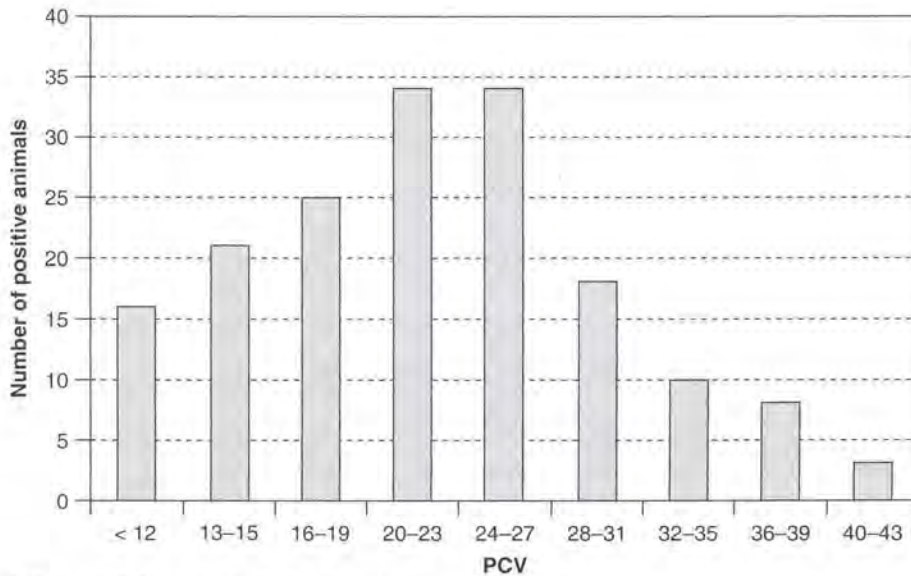

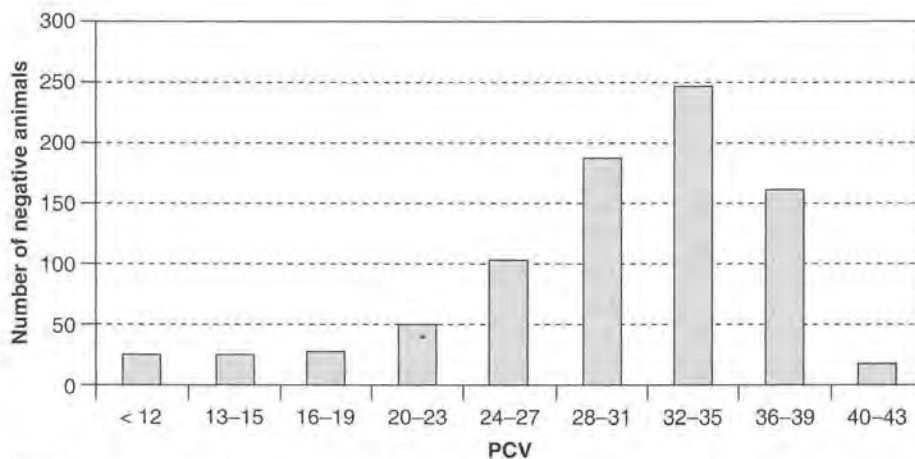
FIG. 1   PCV profile of positive animals

FIG. 2   PCV profile of negative animals

TABLE 1 Trypanosome infection and mean parasitological prevalence of trypanosomosis detected at study locations and mean PCV values of examined animals

Sampling sites	Eco-zone	No. of animals tested	Parasitological result					Mean PCV of positive animals	Mean PCV of negative animals
			Total positives	*T. vivax*	*T. congolense*	Mixed	Prevalence %		
Borkoshie	Midland	136	17	14 (82.3 %)*	3 (17.7 %)	–	12.5	21.9	27.7
Dedekere	Lowland	130	18	15 (83.3 %)	3 (16.7 %)	–	13.8	23.3	26.8
Fagenamata	Lowland	180	35	26 (74.3 %)	9 (25.7 %)	–	19.4	18.7	27.2
Hanaze	Highland	64	6	3 (50.0 %)	3 (50.0 %)	–	9.3	24.2	29.4
Molticho	Lowland	190	36	21 (58.3 %)	14 (38.9 %)	1 (2.8 %)	18.9	19.2	27.0
Mundena	Lowland	82	17	14 (82.3 %)	3 (17.7 %)	–	20.7	18.3	27.0
Soreto	Highland	126	6	4 (66.7 %)	2 (33.3 %)	–	4.7	32.1	33.4
Zamine Nare	Midland	100	17	11 (64.7 %)	6 (35.3 %)	–	17.0	20.4	26.9
Total		1008	152	108 (71.1 %)	43 (28.3 %)	1 (0.6 %)	15.0	22.3	28.0

* Numbers in parenthesis indicate the relative proportion of *T. vivax* and *T. congolense* infection at each site
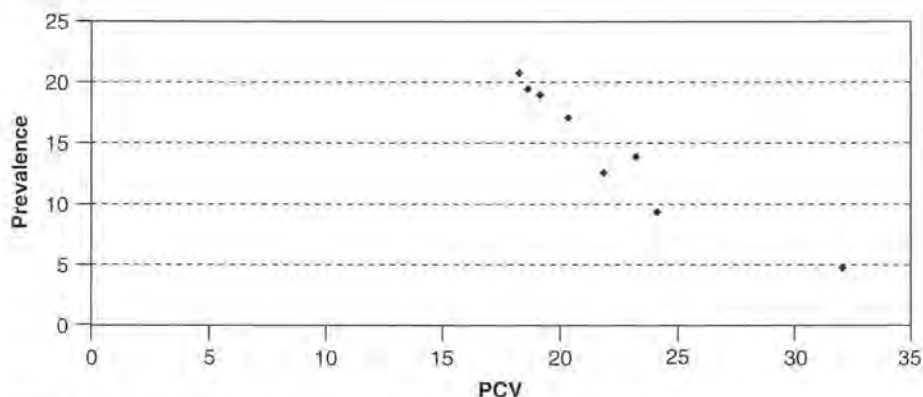
FIG. 3   Scatter plot to show the relation of PCV and percent prevalence

association of PCV with parasitological prevalence was observed (Fig. 3). The mean PCV decreased with increasing proportion of positive animals.

DISCUSSION

The distribution of trypanosomosis, as suggested by the prevalence, showed a more or less similar situation in the surveyed areas. In all the areas, animals were infected by trypanosomes, most often by *T. vivax*. It was also determined that trypanosomosis progressed to the higher altitudes (Soreto and Hanaze) of the district. The majority of infections in these locations were due to *T. vivax* indicating the presence of other potential haematophagus insect vectors other than tsetse flies. There is evidence that non-cyclically transmitted *T. vivax* infection has been detected in other tsetse-free areas of Ethiopia (Balis & Bergeon 1970; Hoare 1970; Roeder, Scott & Pegram 1984).

An epidemiological important observation in this study is the infection of animals with the tsetse-transmitted trypanosome, *T. congolense*, in areas (Hanaze 50 %, Soreto 33.3 % and Zamine Nare 35.3 %) away from the known tsetse belt (Omo River). The localities mentioned above are found at the escarpment where feeder rivers for the Omo River system originate. Therefore it is very likely that tsetse flies migrate uplands, from their original habitat, following the river courses. The movement of tsetse away from their prime habitat when climatic conditions are not favourable in the surrounding areas has been described before (Shircore 1914, cited by Van Den Bossche, Shumba & Makhambera 2000).

It was assumed that tsetse transmitted trypanosome infections (*T. congolense*) would predominate

in Dedekere, Fagenamata, Molticho and Mundena, which are found near the mouth of the Ghibe-Omo valley, where *Glossina fuscipes, Glossina pallidipes* and *Glossina morsitans morsitans* occur (T. Daya, personal communication 1998). However, despite their proximity to tsetse habitat, most positive cases in cattle in Dedekere, Fagenamata, Molticho and Mundena were due to *T. vivax*. Several possible reasons could be forwarded. The ecological condition at the edge of fly belt is normally less favourable resulting in high mortality rate of tsetse (Van Den Bossche, Mudenge, Mubanga & Norval 1999).

In the present observation, however, tsetse flies seem to migrate to the surrounding areas, as evidenced by the high prevalence of tsetse-transmitted trypanosomes in the mid- and highland areas of Kindo Koisha. Migration of tsetse flies when the environment in their preferred habitat is not conducive has been reported (Van Den Bossche *et al.* 2000). Moreover, tsetse flies obtain 10–50 % of their blood meal from reptiles (Itard 1989), which are also known to exist in the Omo River (personal observation). Game animals such as antelopes and warthogs are present in the area and thus the challenge to cattle near the known tsetse foci is reduced. Antelopes are generally accepted to be reservoir hosts of *T. vivax* from which the infections are transmitted to domestic ruminants (Van Den Bossche *et al.* 1999). Mechanical vector insects, such *Tabanus* spp., *Stomoxys* spp. and *Haematopota* spp. are also abundant in these localities (Berhanu 1995). It is considered that the synergistic effect of the conditions mentioned above contributed for the higher *T. vivax* infection of cattle in these areas.

On the basis of the PCV readings, an assumption can perhaps be made on the infection status of ani-

mals with trypanosome. Anaemia, which is best measured by PCV, remains one of the indicators of trypanosomosis in cattle (Woo 1970; Stephen 1986). In the present survey, however, only 74.4 % (113/152) of parasitologically positive animals revealed mean PCV values of < 26 %. The remaining 25.6 % (39/152) of positive animals showed PCV values of > 28 %, which is beyond the normal minimum PCV (Kelly 1967). This finding can be explained by the fact that the microhaematocrit buffy coat technique of detecting trypanosomes in the blood is more sensitive, since it detects slight infections, than that of direct smear examination (Paris, Murray & McOdimba 1982). Earlier reports on the evaluation of the sensitivity of different diagnostic tests have shown to be, in decreasing order, that of microhaematocrit > thick blood smear > thin film > wet film (Luckins 1992).

The microhaematocrit buffy coat technique also has the advantage that it indicates the general condition of the animal by PCV determination. However, in areas where other agents causing anaemia prevail, PCV alone may not be the indicator of choice for detecting trypanosome infections.

The significantly lower PCV reading and yet trypanosome-negative finding in 15.6 % of the animals examined would suggests the concomitant occurrence of other anaemia-causing factors, presumably tick infestation, helminthosis, haemoparasitosis (other than trypanosomosis) and nutritional deficiencies, in the area.

The present survey indicated the distribution and the risk of trypanosomosis as well as the species of trypanosomes involved in the cattle infection in the area. It is recommended that in the short-term chemotherapy through the strategic application of appropriate trypanocidal drugs should be implemented. However, as long as tsetse flies are present trypanosomosis remains a continuing problem inhibiting the full utilization of the land and livestock resources of the area. Therefore a tsetse control strategy to reduce host-tsetse contact is as equally important as is chemotherapy and chemoprophylaxis against trypanosomosis. One of the ideal strategies to reduce tsetse-cattle contact is adjustment of the grazing regime while temperature stress restricts fly mobility.

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