Journal of Medical Entomology, 59(4), 2022, 1099–1143
https://doi.org/10.1093/jme/tjac018
Advance Access Publication Date: 17 May 2022
Review

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Review

African Animal Trypanosomiasis: A Systematic Review on Prevalence, Risk Factors and Drug Resistance in Sub-Saharan Africa

Ivy Okello,[1,2,4] Eliakunda Mafie,[2] Gillian Eastwood,[3] Jahashi Nzalawahe,[2] and Leonard E. G. Mboera[1]

[1]SACIDS Africa Centre of Excellence for Infectious Diseases of Humans and Animals in East and Southern Africa, P.O. Box 3297, Morogoro, Tanzania, [2]Sokoine University of Agriculture, Department of Veterinary Microbiology, Parasitology and Biotechnology, Chuo Kikuu, Morogoro, Tanzania, [3]Virginia Polytechnic Institute & State University, College of Agriculture & Life Sciences, Blacksburg, VA, USA, and [4]Corresponding author, e-mail: ivy.okello@sacids.org

Received 30 August 2021; Editorial decision 19 January 2022

Abstract

African animal trypanosomiasis (AAT) a parasitic disease of livestock in sub-Saharan Africa causing tremendous loses. Sub-Saharan continental estimation of mean prevalence in both large and small domestic animals, risk factors, tsetse and non-tsetse prevalence and drug resistance is lacking. A review and meta-analysis was done to better comprehend changes in AAT prevalence and drug resistance. Publish/Perish software was used to search and extract peer-reviewed articles in Google scholar, PubMed and CrossRef. In addition, ResearchGate and African Journals Online (AJOL) were used. Screening and selection of articles from 2000–2021 was performed according to Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA). Articles 304 were retrieved; on domestic animals 192, tsetse and non-tsetse vectors 44, risk factors 49 and trypanocidal drug resistance 30. Prevalence varied by, host animals in different countries, diagnostic methods and species of *Trypanosoma*. Cattle had the highest prevalence with Ethiopia and Nigeria leading, *T. congolense* (11.80–13.40%) and *T. vivax* (10.50–18.80%) being detected most. This was followed by camels and pigs. Common diagnostic method used was buffy coat microscopy. However; polymerase chain reaction (PCR), CATT and ELISA had higher detection rates. *G. pallidipes* caused most infections in Eastern regions while *G. palpalis* followed by *G. mortisans* in Western Africa. Eastern Africa reported more non-tsetse biting flies with *Stomoxys* leading. Common risk factors were, body conditions, breed type, age, sex and seasons. Ethiopia and Nigeria had the highest trypanocidal resistance 30.00–35.00% and highest AAT prevalence. Isometamidium and diminazene showed more resistance with *T. congolense* being most resistant species 11.00–83.00%.

Key words: African animal trypanosomiasis, prevalence, domestic animal, drug resistance, risk factor

African animal trypanosomiasis (AAT) is a serious livestock disease that affects livestock production in sub-humid and humid regions of Africa (Mattioli et al. 2004). With Surra, an animal trypanosomiasis caused by *Trypanosoma evansi* and affects livestock in tropic and sub-tropic regions of South and Central America, Southeastern Asia and Northern Africa (Sánchez et al. 2015). AAT is known to cause economic losses of upto 4.5 billion dollars (Holt et al. 2016), thus affecting economic growth in sub-Saharan Africa (Steverding et al. 2008a). Domestic animals affected by AAT include cattle, goats, camels, sheep, dogs, donkeys and pigs (Nimpaye et al. 2003, Hamill et al. 2013, Birhanu et al. 2015). The burden of the disease has been numerous in sub-Saharan Africa (Mattioli et al. 2004, Steverding 2008b). The disease is caused by several species of trypanosomes (Table 1).

Symptoms of AAT in cattle include emaciation, watering eyes, swollen lymph nodes, and anaemia (Bekele 2016). In dogs, clinical signs include infestation with endoparasites such as round worms and ectoparasites such as ticks, swollen lymph nodes, faded mucous membrane, and corneal opacity (Lisulo et al. 2014), In camels, clinical signs include; oedema, fever, diarrhoea, corneal opacity and weight loss (Chaudhary and Iqbal 2000).In goats, there is usually reduced fertility due to destruction of the ovary (Ikede and Akpavie 1982).

Table 1. Different *Trypanosoma* spp. affecting animals adapted from (Fineile et al. 1983)

Trypanosoma species	Animals affected
Trypanosoma congolense	Cattle, sheep, goat, pigs, dogs, camels wild animals
Trypanosoma vivax	Domestic ruminant like goats and cows and wild ruminants
Trypanosoma brucei	Domestic and wild animals
Trypanosoma simiae	Wild and domestic pigs
Trypanosoma evansi	Camel cattle, dog and horse

Tsetse flies (*Glossina* spp.) are the major biological vectors of trypanosomes and they transmit the pathogen when they feed on an infected host via cyclic transmission. The major species of animal trypanosomes transmitted by tsetse flies in livestock are *Trypanosoma congolense, Trypanosoma vivax, Trypanosoma brucei, Trypanosoma simiae*, and *Trypanosoma godfreyi* (Hamill et al. 2013). Life cycle of tsetse flies involves replication of non-infective procyclic forms of trypanosomes in midgut and after 3 wk, movement to salivary glands upon which the parasites differentiate into nonreplicating infective metacyclic forms (Desquesnes et al. 2009). Tsetse flies are found exclusively in many regions of the African continent between latitudes 14°N and 20°S (Kabede 2009). They are classified into three major subgenera depending on the ecological environment they occupy: the forest-dwelling (*fusca*), savanna (*mortisans*), and riverine (*palpalis*) (Wamwiri and Changasi 2016). Some *Glossina* species are hematophagous and can transmit trypanosomes (Glover 1948).

Other biting flies like the *stomoxys* and *tabanids* have also been identified to pose a risk of transmission of animal trypanosomasis (Adungo et al. 2020, Ngari et al. 2020). They can be found in different regions in Africa (mostly Northern Africa) and Latin America (Desquesnes and Dia 2003, 2004). *Stomoxys* and *tabanids* can also transmit animal trypanosomes via mechanical transmission (from one host to another without multiplying or developing in the vector (Desquesnes et al. 2009). The major species of trypanosomes transmitted mechanically include *T. evansi* due to its disappearance of maxicircle of mitochondrial DNA (Lai et al. 2008, Desquesnes et al. 2009). Other species include *T. vivax* which can be transmitted mechanically when there is no biological vector around and *T. theileri* (Pollock 1982, Desquesnes and Dia 2004).

Diagnosis of the trypanosomiasis is commonly done clinically and confirmed by microscopic examination, serological, and highly sensitive molecular polymerase chain reaction (PCR) techniques (Gadahi et al. 2013). Different diagnostic techniques have been applied for the detection of AAT in sub-Saharan Africa. These include microscopic examination which can be wet or stained blood samples viewed under a microscope, buffy coat technique such as the quantitative buffy coat (QBC). QBC detects parasites after spinning blood in a capillary tube, and releasing buffy coat layer (white blood cells containing parasites) in a glass slide for viewing under a microscope (Chagas et al. 2020). Dark ground hematocrit centrifuge technique (DG-HCT), which is an improvement of the fresh stained blood examination test using hematocrit tube to centrifuge and concentrate blood (Paris et al. 1982). Microscopic examination is normally a fast-easy technique used at the field level. However, it is considered a less sensitive diagnostic technique. On the other hand, molecular diagnosis is a highly sensitive technique and gives a truer indication of the prevalence rate in animals (Kouadio et al. 2014). Serological techniques such as card agglutination test for trypanosomiasis (CATT), to detect antibodies specific to *Trypanosoma* antigens, and enzyme-linked immunosorbent assay (ELISA) which uses antigens to detect *Trypanosoma* antibodies present in the animals blood have been used (Chappuis et al. 2005, OIE 2018). However, the antigens used to detect antibodies are poorly defined, making it hard for test standardization. In addition, antibodies may exist due to previous infections (Nantulya 1990). Molecular PCR technique which uses specific sets of primers to amplify unique regions within the parasite DNA, has also been used in the diagnosis of AAT. Other diagnostic techniques include Loop-mediated isothermal amplification (LAMP), which is highly specific and fast technique, and uses a set of four unique primers to identify six well-defined regions within target DNA sequence (Notomi et al. 2000); Flinders Technology Associates-Polymerase chain reaction (FTA-PCR), which is a combination of preservation of DNA from blood samples in filter paper and PCR amplification of specific DNA regions (Nuchprayoon et al. 2007, Cox et al. 2010). Molecular diagnosis is highly sensitive and gives a truer indication of the prevalence rate in animals (Kouadio et al. 2014). Nevertheless, it is considered an expensive test and used less frequently.

Control of AAT is currently executed at the tsetse fly vector level, use of trypanotolerant breeds of cattle and at parasite level using trypanocidal drugs which can be either chemotherapeutic or chemoprophylactic drugs. In earlier years, the control measures applied against tsetse had negative environmental effects; these included ground spraying with DDT chemicals, bush clearing causing killing of weaker and infected wildlife. Later, improved methods were applied such as insecticide-treated cattle (ITC), insecticide-treated traps and target (ITT), using sterile insects, selective bush clearing, and sequential aerial spraying (Allsopp 2001, Vreysen et al. 2013). ITT has disadvantage of expensiveness hence lack of persistence, sterile insects are species-specific and it's hard to separate male insects for irradiation, sequential aerial spraying requires skilled personnel and high tech equipment (Garros et al. 2018). Disadvantage is it leads to reduction of good micro-organisms involved in cattle dung breakdown (Vale and Grant 2002, Vale et al. 2004), also it may lead to acaricide drug resistance in controlling tick population. Recently, a more environmentally and economical method was developed whereby, insecticides are applied in defined regions of cattle where tsetse flies like to feed on, such as the stomach and legs. The technique is known as restricted application protocol (RAP) (Bourn et al. 2005, Torr et al. 2007).

Due to drawbacks of vector control methods, trypanotolerant breeds have been used to control AAT. These are considered as breeds that are less susceptible to AAT. An example is the N'Dama breed and Baoule' breed from Togo and Burkina Faso in West Africa, the breeds are known to be more resistant to AAT than the Zebu (Silbermayr et al. 2013, Maganga et al. 2017, Yaro et al. 2016). This is due to their stable phenotype. However, this cannot be extrapolated in natural environment as these were performed in an experimental setting, where all the conditions including nutrition were favorable for fighting diseases (Mortelmans 1976).

Control of AAT using trypanocidal drugs has also been used in sub-Saharan countries. Commonly used drugs against AAT are isometamidium chloride, homidium chloride or bromide, and diminazene aceturate (Shaw 2004). Isometamidium is active against *T. vivax* and *T. congolense* in cattle, sheep, goats, buffalos, donkeys, and camels, but is less effective on *T. brucei*. Diminazene on the other hand is effective against both *T. congolense, T. vivax* and *T. brucei* in cattle and other domestic animals at different doses (Fineile et al. 1983, Giordani et al. 2016a). However, the control of AAT by trypanocidal drugs has had some challenges. This is due to some species of trypanosomes being resistant to the trypanocidal drugs used (Chitanga et al. 2011). Drug resistance can be defined as lack or reduction of sensitivity of trypanosomes to trypanocidal drugs, at the recommended therapeutic dosage. Easy acquisition of trypanocidal drugs without prescription has led to, over frequent use and under-dose usage of trypanocidal drugs by some livestock farmers. In addition, the use of poor quality drugs has also led to the development of drug-resistant trypanosomes (Van Den Bossche et al. 2000, Delespaux et al. 2002). Drug resistance has been reported in most regions where AAT is endemic (Delespaux and de Koning 2007). Hence, limiting the efforts of eliminating the disease in those countries (Delespaux et al. 2002, Moti et al. 2012). Cases of trypanocidal drug resistance have been documented in 21 African countries so far (Delespaux et al. 2008a, Chitanga et al. 2011). In addition to Zambia (Sinyangwe et al. 2004). With risk of spread to other sub-Saharan countries such as Gabon (Maganga et al. 2017), Senegal (Seck et al. 2005), South Africa (K Gillingwatera 2010) where AAT drug resistance have not been reported. There has been a high increase in drug-resistant trypanosomes against isometamidium and dimenazene (Geerts et al. 2001, Delespaux and de Koning 2007). Resistance rates can vary accordingly to *Trypanosoma* species and the drugs used. Drug-resistant trypanosomes have a loss of transporter genes *TbAT1* and *TcoAT1* which hinders uptake of the drug in trypanosomes (Delespaux et al. 2006, Medina and Mingala 2016). This could be due to a point mutation in *T. congolense* adenosine transporter gene *TcoAT1* preventing uptake of diminazene (Delespaux and de Koning 2007), 6 point mutations in *T. brucei (TbAT1)* hindering diminazene uptake (Mäser et al. 1999), or due to unknown reasons or cross resistance to homidium causing *T. vivax* resistance to diminazene and isometamidium respectively (Gray and Roberts 1971, Keas et al. 2005).

Multidrug resistance to both isometamidium and diminazene can also occur. This also pose a major problem in controlling AAT in some African countries (Delespaux et al. 2008a, Giordani et al. 2016b). Multidrug resistant species have been reported in Sudan, Zambia, Ethiopia, Nigeria, Togo, and Kenya (Mohammed-Ahmed et al. 1992, Sinyangwe et al. 2004, Tchamdja et al. 2017, Solomon and Workineh 2018). Other countries where species of trypanosomes infecting cattle have shown multitreatment failure to isometamidium and diminazene at varying levels include Mozambique (Mulandane et al. 2018), Mali (Mungube et al. 2012), Zambia (Sinyangwe et al. 2004, Chitanga et al. 2011), and Zimbabwe (Joshua et al. 1995).

Several studies, reviews, and meta-analysis have been done on the prevalence of specific species of *Trypanosoma* as the *T. vivax* and *T. evansi* at the global level (Aregawi et al. 2019, Fetene et al. 2021), bovine trypanosomiasis (Holt et al. 2016, Ebhodaghe et al. 2018a), small ruminants and pigs trypanosomiasis in sub-Saharan countries (Ebhodaghe et al. 2018b) and AAT at national level in countries like Nigeria (Odeniran and Ademola 2018). However, there is less data on the mean prevalence in sub-Saharan continental level in both large and small domestic animals and its association to drug resistance, associated risk factors, and tsetse and non-tsetse populations and their infections rates from 2000-2021.

The aim of this review was to determine the prevalence of AAT in both large and small domestic animals using the different diagnostic tests, drug resistance and its association to AAT prevalence, risk factors, tsetse and non-tsetse populations, and infection rates in sub-Saharan countries. This was done to better comprehend the changes in the disease prevalence using the different diagnostic tools used to determine prevalence, disease pattern in different domestic animals, associated risk factors, and drug resistance over the past 21 years. This data will be useful in evaluating the effectiveness of control programs against AAT and also improve control strategies, preventive measures and strengthen government policy on the use of drugs

Method

Screening and selection of articles were performed according to Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) procedures (Moher et al. 2009) (Fig. 1). This was done to ensure appropriate articles are included in the review.

Literature Search

In May 2021 and September, a search for literature was made from Google scholar, PubMed CrossRef, Researchgate, and AJOL. Search terms 'African animal trypanosomes' OR 'African trypanosomiasis' OR 'Nagana' OR 'prevalence' OR 'tsetse infection' OR 'biting flies' OR 'risk factors' OR 'drug resistance' OR 'sub-Saharan Africa' OR 'particular country name'. Publish or Perish software was used to search for peer-reviewed articles published in the mentioned databases and later the list of papers were downloaded and imported into Rayyan for screening if they met the inclusion criteria mentioned below (Harzing 2007, Ouzzani et al. 2016). In addition, the quality of articles was also checked with considerations as listed below.

Inclusion and Exclusion Criteria

Only articles written in English and published from 2000 to 2021 were considered for the analysis. These are the years when tsetse eradication programs such as PATTEC have been running since their establishment in Africa (FAO 2001) Articles mentioning; African animal trypanosomes or animal trypanosome infection in large and small domestic ruminants and nonruminants, with method of diagnosis mentioned, those mentioning the total number of animals sampled, the species of trypanosomes causing infections, associated risk factors to AAT, tsetse infections, biting flies associated with AAT and trypanocidal drug resistance with species of *Trypanosoma* mentioned in sub-Saharan African countries were included in analysis. These articles were downloaded and imported into Mendley reference manager. Articles not written in English, those outside the study period 2000–2021, studies on AAT in wild animals, not mention diagnosis method used to determine the prevalence, not mentioning the country, experimental studies, and those mentioning tsetse without mentioning their infections or mention drug resistance without quantifying the level of drug resistance and those mentioning human AAT without animals, review articles and articles on experimental studies (except experimental studies on drug resistance) were excluded from meta-analysis.

Quality Assessment

Assessment of quality of articles was done with major considerations on; articles that were published in peer reviewed journals, study animals and geographical locations were mentioned, appropriate sample size was included and used, authentic methods were used for diagnosis, risk factors were assessed based on associated prevalence rates, valid tsetse and non-tsetse vectors and detection methods were used for assessing *Trypanosoma* prevalence in tsetse, right trypanocidal drugs as indicated by manufacturers for use against African animal trypanosomes were used for, identification of trypanosomes drug resistance and drug-resistant *Trypanosoma* species.

Data Extraction

Included articles were used for data extraction and put in Excel spread sheet. Extracted data included; main author and year of publication, country, type of animal, total number of sampled animals, overall prevalence rate, species of *Trypanosoma*, diagnostic method

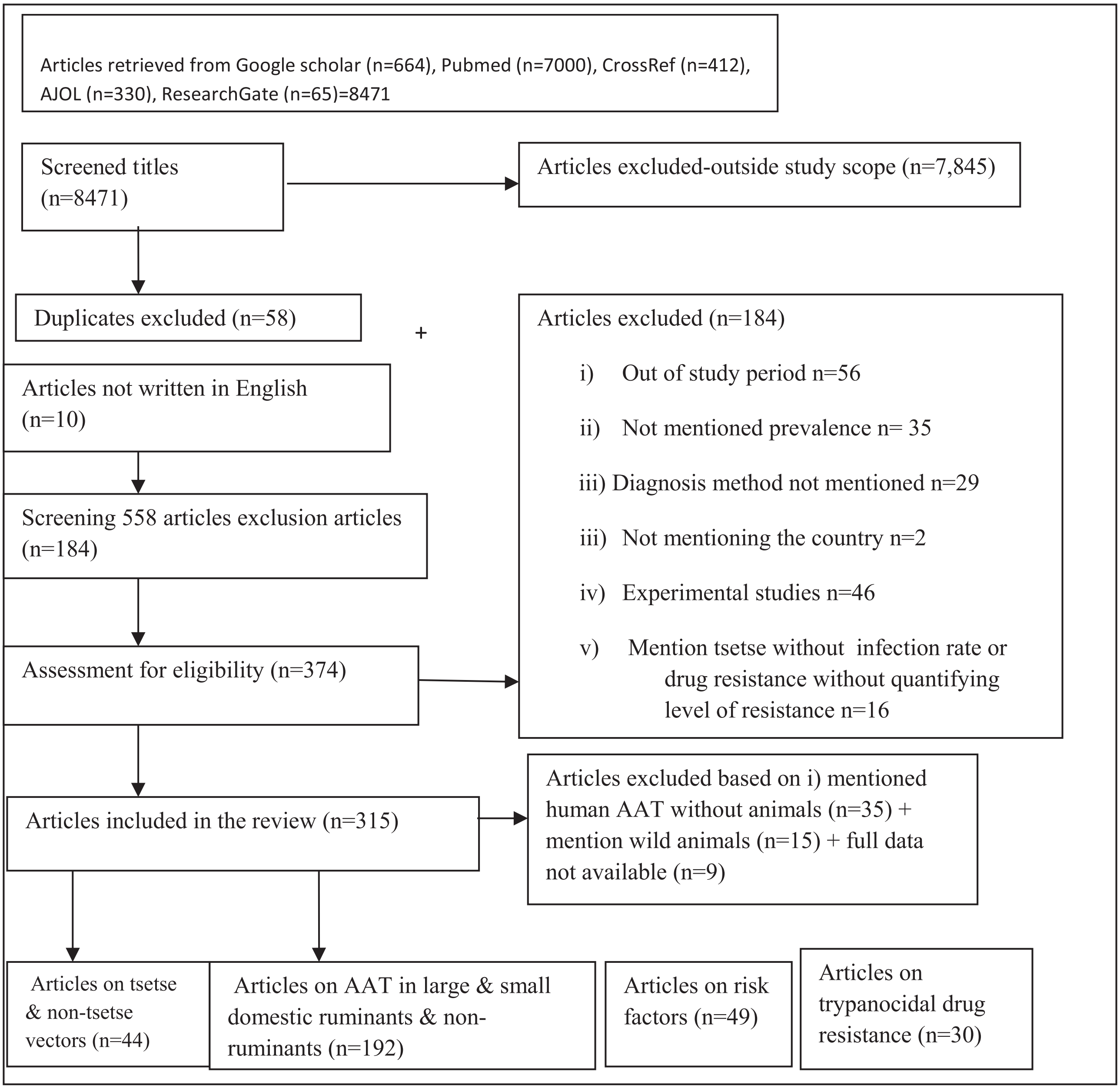

Fig. 1. PRISMA process of selection.

used, risk factors, species of tsetse flies, tsetse prevalence, species of *Trypanosoma,* trypanocidal drug and *Trypanosoma* species of resistance, prevalence of resistance. Data were then exported to STATA for analysis after coding.

Data Analysis

A Meta-analysis was performed using *Metaprop* program in STATA (Nyaga et al. 2014). The program uses binomial data and computes confidence intervals of both binomial and test score data. Pooled estimates (ES) of prevalence were determined using level of heterogeneity-percentage of variation in the studies (*I*^2**). Level of heterogeneity was determined by the fixed and random effects. Random effects considered measures of variability while fixed effects assumed lack of variability in the studies analyzed (Higgins and Thompson 2002). A 75–100% (*I*^2**) corresponded to high level of heterogeneity. Prevalence was analyzed based on regions and countries in sub-Saharan Africa, host animals, diagnostic methods used to determine prevalence rate, species of *Trypanosoma*, and tsetse and non-tsetse vector species and their infections. Publication bias was assessed using *metabias* program in STATA.A one way ANOVA was conducted to determine if there was a difference in the prevalence of trypanosoma species between the two periods 2000–2010 and 2011–2021. Drug resistance analysis was done based on the different countries, trypanocidal drugs used, and species of *Trypanosoma* showing resistance within those countries. In addition, analysis was done based on trypanocidal drugs and species of *Trypanosoma*. Risk factors were analyzed based on the common risks showing higher prevalence in the host animals. These were also analyzed using *Metaprop* program.

Results

A total of 8,471 articles were retrieved, 664 from Google scholar, 7,000 from PubMed, 412 from CrossRef, 330 AJOL, and 65 ResearchGate (Fig. 1). Titles of articles outside study scope (not mentioning AAT in sub-Saharan countries, risk factors, drug resistance, and review articles were excluded 7,845 from the analysis. Duplicates 58, those not written in English 10, were identified and excluded. Remaining 558 articles were screened based on information in the abstract and titles. Articles out of study period 56, articles mentioning AAT without mentioning prevalence rates 35, or diagnosis method 29, those that didn't mention the country, experimental studies 46, tsetse infection rate or quantify level of drug resistance 16, were excluded. Remaining 374 articles were assessed for desirable inclusion and exclusion criteria. Additional 35, 15, and 9 articles were excluded as they mentioned humans without including animals, others mentioned wild animals only and others full information on article was not easily accessible respectively. Articles included in the review 315, whereby, articles on tsetse & non-tsetse vectors 44, articles on AAT in large and small domestic ruminants and nonruminants 192, articles on risk factors 49, and articles on trypanocidal drug resistance 30 (Table 3).

Prevalence in Cattle

A total of 182,390 cattle got tested, 33,775 were found positive for the disease from 140 studies (Table 2). Prevalence in cattle was highest 18.57% (95% CI: 13.00–20.00%) with *T. vivax* 2.90–34.80% and *T. congolense* 5.50–25.10% being detected more. Ethiopia had the highest prevalence in cattle 18.85% (95% CI: 11.82–20.55%. I^2 = 99.91%, P < 0.05). This was followed by Nigeria 17.70% (95% CI: 7.70–17.80%. I^2 = 99.96%, P < 0.05). On the other hand, Togo and Senegal had the lowest prevalence 3.40% (95% CI: 1.20–5.50% and 4.90% (95% CI: 4.10–11.80%. Buffy coat microscopy was the most commonly used technique from 85 studies'. However, PCR and CATT had higher detection rates at 40.00% and 36.00% respectively.

Prevalence in Camels

Out of 9,967 camels tested, 1,824 were positive from 12 studies. Overall mean prevalence was 18.30% (95% CI: 12.50–20.00%) (Table 2). Ethiopia again reported the highest prevalence 35.20% (95% CI: 25.60–24.80%. I^2 = 98.00%, $P < 0.05$). Nigeria showed the least prevalence rates. CATT had the highest detection rate 52.30% (95% CI: 45.70–58.90%. I^2 = 0.02%, $P < 0.05$), among the used diagnostic tools. *T. evansi* 3.50–37.90% was the most detected *Trypanosoma* species. *T. vivax* and *T. theileri* were also detected. On the other hand, there were no *T. congolense* species detected.

Prevalence in Pigs

Out of 21,087 pigs tested, 3,299 were found positive for trypanosome infection from 22 studies'. Overall prevalence was 15.65% (95% CI: 10.00–22.00%). Cameroon showed the highest prevalence 38.00% (95% CI: 27.00–42.00%. I^2 = 96.41%, $P < 0.05$) (Table 2). On the contrary, Tanzania showed the lowest cases, 3.90% (1.70–6.10%). Species-specific PCR had the highest detection rate, 52.40% (95% CI: 45.90–59.00%). *T. brucei* was commonly detected in all the studies, with human infective *T. brucei* sensu lato (*T. brucei* sI) the species whose sub-species *T. brucei rhodesiense* and *T. brucei gambiense* cause Human African trypanosomiasis (HAT) (Cayla et al. 2019) 43.00% (95% CI: 21.00–66.00%) and *T.brucei rhodesiense* 47.40% (95% CI: 45.50–49.20%) were the highly detected sub-species. *T. congolense* was lowly detected in most studies (10), with some not reporting any.

Prevalence in Sheep

Among the 13,177 sheep tested, 1,682 turned positive from 24 studies included in the analysis. Overall prevalence was 12.76% (95% CI: 10.54–17.85%) (Table 2). In the countries included, Nigeria recorded the highest prevalence 16.50% (95% CI: 8.10–24.90%). Again, species-specific PCR gave the highest detection, with *T. brucei* being common in most sheep's and *T. brucei* sI the highest detected species 41.30% (95% CI: 31.70–47.80%). Mixed infections of *T. vivax* and *T. congolense* were also common.

Prevalence in Goats

A total of 30 studies reported on AAT in goats. Approximately, 40,827 goats got tested, and 4,842 were positive for the infections (Table 2). Overall prevalence was 11.85% (95% CI: 9.85–17.25%). Nigeria showed the highest prevalence 18.20%, with ELISA detecting more *Trypanosoma* than other diagnostic techniques. *T. brucei* sI, *T. Congolense*, and *T. vivax* were the highly detected species of *Trypanosoma* at 43.00% (95% CI: 3.20–89.20%), 23.10% (95% CI: 19.80–65.90%), and 23.00% (95% CI: 5.20–40.90%) distributively.

Prevalence in Dogs

Five studies reported on AAT in dogs. From these studies, 1,802 dogs got tested, 67 were positive for the disease. An overall prevalence of 3.71% (95% CI: 2.54–6.78%) was detected (Table 2). Cameroon was the country that showed the highest prevalence, 11.20% (95% CI: 4.10–18.20%. I^2=53.09%, P < 0.05). On the other hand, Zambia had the lowest prevalence, 1.70% (95% CI: 0.60–2.80%). Diagnosis with CATT gave the highest detection rates, 30.00% (95% CI: 9.90–50.10%). Again, *T. brucei* was commonly detected in all the studies, with *T. brucei* sI the highest detected species. On the other hand, *T. congolense* was least in dogs.

Prevalence in Donkeys

Among 3,195 donkeys tested, 118 got infected with animal trypanosomes (Table 2). An overall prevalence of 3.69% (95% CI: 2.54–6.85%) was detected. Uganda reported a higher prevalence, 17.10% (95% CI: 6.30–40.60%) ITS1-PCR having a high detection rate.

Publication Bias

Publication bias was assessed in host animals with sufficient articles reporting on prevalence. These included cattle, pigs, camel, goats, sheep, donkeys, and dogs. Small study effects were seen with P < 0.05 in the metabias analysis.

Tsetse and Non-Tsetse Prevalence Rates in Western and Eastern Africa

A total of 33 studies got retrieved on tsetse and non-tsetse species, their infection rates, and species of Trypanosoma causing their infections from two regions (Western and Eastern Africa) (Table 4). These represented regions with countries that had reported a high prevalence of AAT in different host animals. Average of 151,147 tsetse and other biting flies were assessed. Out of these, tsetse flies 127,245, *stomoxys* 18,182, *tabanids* 5,448, *Hippobosca camelina* (n = 150), *Pangonia rueppellii* (50) were identified. Overall prevalence based on tsetse and non-tsetse species was 21.00% (95% CI: 16.00–28.00%). Eastern region had more of *G. pallidipes*, *G. fuscipes*,

Table 2. Prevalence of AAT in different host animals under different countries

Characteristic	No. of studies & total sample size	Prevalence (95% CI)	Measure of Heterogeneity	% of variation (I^2**)	P-value
Overall (cattle)	140 (182,390)	18.57% (13.00–20.00%)	65625.26	99.95	$P < 0.05$
Ethiopia (cattle)	62 (136,170)	18.85% (11.82–20.55%)	17737.28	99.91	$P < 0.05$
PCR	2	40.00% (13.60–66.40%)	439.23	99.46	$P < 0.05$
ELISA	1	10.60% (3.60–17.60%)	41.09	93.89	$P < 0.05$
ITS1-PCR	5	10.00% (1.50–18.60%)	573.85	99.68	$P < 0.05$
PCR-RFLP	2	6.20% (4.20–7.70%)	11336.81	99.88	$P < 0.05$
Buffy coat microscopy	55	5.70% (0.40–11.80%)	118.06	99.29	$P > 0.05$
Hematocrit centrifugation	6	4.70% (1.80–7.50%)	286.42	99.11	$P < 0.05$
Wet smear microscopy	3	3.30% (1.75–5.85%)	1559.59	99.63	$P < 0.05$
T. congolense	60	13.40% (9.10–17.70%)	12076.15	99.84	$P < 0.05$
T. vivax	65	10.50% (4.50–8.60%)	2943.10	99.50	$P < 0.05$
T. brucei	29	6.50% (3.90–8.90%)	163.42	99.39	$P > 0.05$
T. vivax & *T. congolense*	27	2.30% (1.30–5.90%)	422.59	99.39	$P < 0.05$
T. theileri	3	2.20% (1.00–3.30)	90.12	98.83	$P < 0.05$
T. evansi	2	2.10% (1.10–3.30%)	262.56	99.35	$P < 0.05$
T. vivax & *T. brucei*	3	1.00% (0.20–2.20%)	6.40	79.52	$P > 0.05$
T. congolense & *T. brucei*	2	0.50% (0.10–1.00%)	0.05	0.03	$P < 0.05$
Nigeria (cattle)	15 (39,697)	17.70% (7.70–17.80%)	8462.86	99.96	$P < 0.05$
PCR	2	17.90% (4.20–31.70%)	488.23	99.43	$P < 0.05$
Species-specific PCR	1	15.50% (2.30–28.80%)	3187.08	99.88	$P < 0.05$
Buffy coat microscopy	8	10.90% (1.30–20.40%)	997.02	99.99	$P < 0.05$
Hematocrite centrifugation technique	7	1.90% (0.10–3.80%)	1253.44	99.63	$P < 0.05$
T. vivax	15	18.80% (7.30–30.40%)	3083.67	99.82	$P < 0.05$
T. congolense	10	11.80% (2.20–21.50%)	3131.82	99.95	$P < 0.05$
T. brucei	9	9.20% (3.30–15.20%)	623.47	99.86	$P < 0.05$
T. evansi	1	8.90% (3.50–10.85%)	0.00	0.00	$P < 0.05$
T. vivax & *T. congolense*	2	6.90% (6.60–20.40%)	65.31	98.47	$P > 0.05$
South Africa (cattle)	3 (2,965)	14.10% (3.50–31.70%)	507.55	99.82	$P > 0.05$
Species-specific PCR	2	16.00% (6.20–38.30%)	496.37	99.86	$P < 0.05$
Hematocrit centrifugation	1	6.60% (4.30–8.80%)	0.00	–	$P < 0.05$
T. congolense	2	21.90% (5.50–49.30%)	299.69	99.67	$P > 0.05$
T. vivax	1	4.50% (2.90–6.00%)	0.00	–	$P < 0.05$
T. vivax & *T. congolense*	1	0.70% (0.10–1.40%)	0.00	–	$P < 0.05$
Sudan (cattle)	4 (4,273)	13.50% (5.00–34.00%)	16903.28	99.87	$P < 0.05$
CATT	2	36.00% (29.80–52.20%)	0.00	–	$P < 0.05$
KIN-PCR	1	35.00% (7.20–95.80%)	1960.96	99.85	$P > 0.05$
Species-specific PCR	1	15.10% (6.10–36.20%)	91.32	99.42	$P < 0.05$
Buffy coat microscopy	1	6.00% (0.10–11.90%)	43.29	97.24	$P < 0.05$
Wet smear microscopy	1	1.60% (0.80–2.40%)	0.00	0.00	$P < 0.05$
T. vivax	4	34.80% (13.10–56.60%)	28.39	96.48	$P < 0.05$
T. congolense	3	25.10% (4.10–46.10%)	38.85	98.03	$P < 0.05$
T. evansi	1	24.00% (12.90–25.90%)	15576.36	99.96	$P < 0.05$
T. brucei	1	2.90% (1.20–4.50%)	0.00	0.00	$P < 0.05$
T. congolense & *T. vivax*	2	1.00% (0.10–3.00)	1.88	46.84	$P < 0.05$
Burkina Faso (Cattle)	3 (9,543)	11.00% (10.00–27.00%)	1175.60	99.81	$P < 0.05$
PCR	1	21.00% (2.00–44.00)	757.54	99.89	$P > 0.05$
ELISA	1	13.00% (2.00–25.00%)	323.06	99.17	$P < 0.05$
Buffy coat microscopy	2	4.00% (1.00–8.00%)	51.26	95.13	$P < 0.05$
T. vivax	3	20.00% (3.00–44.00%)	843.12	99.87	$P > 0.05$
T. congolense	3	11.00% (2.00–19.00%)	213.07	98.84	$P < 0.05$
T. brucei	2	1.00% (0.30–2.00)	3.53	71.65	$P < 0.05$
Coˆte d'Ivoire (Cattle)	3 (2,250)	10.00% (3.00–22.00%)	291.03	97.02	$P < 0.05$
Species-specific PCR	1	19.00% (14.00–54.00%)	31.65	84.61	$P < 0.05$
PCR	2	18.00% (10.00–25.00%)	0.00	0.00	$P < 0.05$
Buffy coat microscopy	2	11.00% (3.00–19.00%)	44.37	95.06	$P < 0.05$
T. congolense	2	25.00% (16.00–34.00%)	19.99	95.00	$P < 0.05$
T. vivax	2	18.00% (1.00–38.00%)	203.94	98.70	$P > 0.05$
T. brucei sI	1	17.00% (9.00–25.00%)	0.00	0.00	$P < 0.05$
Cameroon (cattle)	6 (13,155)	9.20% (3.60–9.60%)	775.52	99.49	$P < 0.05$
Nested PCR	2	14.30% (4.40–24.10%)	473.99	98.60	$P < 0.05$
ELISA	2	9.50% (3.20–15.80%)	13.79	87.41	$P < 0.05$
Buffy coat microscopy	6	3.70% (1.60–5.90	224.36	98.77	$P < 0.05$

Table 2. Continued

Characteristic	No. of studies & total sample size	Prevalence (95% CI)	Measure of Heterogeneity	% of variation (I^2**)	*P*-value
T. vivax	6	12.20% (4.30–20.00%)	205.10	99.09	$P < 0.05$
T. congolense	6	9.80% (4.60–24.20%)	320.80	98.90	$P < 0.05$
T. brucei	5	4.20% (0.02–8.50%)	96.71	98.88	$P < 0.05$
T. theileri	2	5.70% (0.80–10.70%)	23.65	95.77	$P < 0.05$
T. grayi	1	0.30% (0.20–0.80%)	0.00	0.00	$P > 0.05$
T. congolense & *T. vivax* + *T. brucei* rhodesiense	2	0.40% (0.10–0.90%)	0.32	0.05	$P < 0.05$
Tanzania (cattle)	9 (17,036)	9.50% (5.70–13.20%)	2007.20	99.59	$P < 0.05$
Nested PCR & LAMP-PCR	2	17.40% (6.70–28.20%)	577.28	99.44	$P < 0.05$
LAMP-PCR	4	12.50% (6.30–18.70%)	306.05	98.28	$P < 0.05$
ITS1-PCR & LAMP-PCR	1	11.00% (1.80–20.10%)	105.06	98.07	$P < 0.05$
ITS1-PCR	2	2.40% (0.60–4.10%)	0.00	0.00	$P < 0.05$
PCR	3	2.20% (0.20–4.70%)	6.09	70.65	$P > 0.05$
Buffy coat microscopy	3	2.00% (0.10–4.00%)	49.87	97.08	$P < 0.05$
T. congolense	8	10.60% (0.40–21.60%)	342.51	99.78	$P > 0.05$
T. brucei	5	9.80% (1.80–17.90%)	325.18	99.28	$P < 0.05$
T. vivax	6	8.40% (1.60–15.20%	778.29	99.47	$P < 0.05$
T. simiae	3	2.30% (1.55–3.07%)	6.05	83.46	$P < 0.05$
Uganda (cattle)	13 (50,791)	8.40% (5.90–11.00%)	3237.50	99.89	$P < 0.05$
PCR	4	13.10% (5.60–20.10%)	189.63	97.82	$P < 0.05$
ITS1-PCR	5	12.10% (5.00–19.10%)	607.39	99.74	$P < 0.05$
Species-specific PCR	2	5.50% (1.30–12.40%)	276.96	99.74	$P < 0.05$
Hematocrite centrifugation	4	5.60% (0.90–10.30%)	879.93	99.83	$P < 0.05$
Buffy coat microscopy	1	0.80% (0.20–1.40%)	62.74	96.55	$P < 0.05$
T. vivax	9	10.60% (5.60–15.50%)	1059.01	99.37	$P < 0.05$
T. brucei	9	12.20% (5.80–18.60%)	649.81	99.67	$P < 0.05$
T. congolense	8	6.00% (1.60–10.40%)	182.81	99.58	$P > 0.05$
T. brucei sI	3	6.40% (2.30–15.20%)	298.01	99.58	$P < 0.05$
T. evansi & *T. brucei*	2	5.30% (4.90–15.40%)	66.99	98.51	$P < 0.05$
T. vivax & *T. brucei*	2	1.70% (1.10–2.30%)	0.00	0.00	$P < 0.05$
T. brucei rhodesiense	1	1.10% (0.50–1.60%)	0.16	0.01	$P < 0.05$
Kenya (cattle)	9 (115,718)	7.80% (3.70–8.70%)	1746.85	99.94	$P < 0.05$
Nested PCR	2	9.20% (3.10–21.50%)	27.91	95.85	$P > 0.05$
PCR	3	9.00% (5.00–13.00%)	1179.75	98.98	$P < 0.05$
ITS1-PCR	1	3.10% (2.20–8.30%)	4.16	34.21	$P < 0.05$
Buffy coat microscopy	3	2.60% (0.70–4.50%)	212.45	99.99	$P > 0.05$
T. vivax	6	18.30% (16.80–19.70%)	399.75	99.32	$P < 0.05$
T. congolense	4	12.80% (11.50–14.00%)	16.07	95.50	$P < 0.05$
T. brucei	4	10.90% (5.20–16.50%)	0.00	0.00	$P < 0.05$
T. brucei sI	1	4.80% (1.80–6.20%)	0.00	0.00	$P < 0.05$
T. brucei rhodesiense	1	1.10% (0.10–2.20%)	17.22	80.58	$P < 0.05$
Ghana (cattle)	3 (3,322)	7.80% (0.08–16.30%)	163.03	99.91	$P > 0.05$
ITS1-PCR	1	26.60% (6.40–46.70%)	16.64	93.99	$P < 0.05$
PCR	1	8.70% (6.30–11.20%)	8.25	47.56	$P < 0.05$
Buffy coat microscopy	1	0.50% (0.10–0.80%)	0.00	0.00	$P < 0.05$
T. congolense	2	19.10% (15.60–53.80%)	77.02	98.70	$P > 0.05$
T. congolense & *T. brucei*	2	16.40% (10.40–22.50%)	0.00	0.00	$P > 0.05$
T. vivax	2	8.70% (6.30–11.20%)	0.00	0.00	$P > 0.05$
T. brucei	2	1.00% (0.10–1.90%)	0.00	0.00	$P < 0.05$
Mozambique (cattle)	2 (51,152)	6.80% (5.40–10.00%)	301.02	99.74	$P < 0.05$
Buffy coat microscopy	2	14.20% (8.40–20.00%)	301.02	99.74	$P < 0.05$
T. congolense	2	18.80% (11.10–26.40%)	15.82	93.68	$P < 0.05$
T. vivax	1	10.00% (9.50–10.40%)	0.00	0.00	$P < 0.05$
T. brucei sI	1	9.80% (9.30–10.20%)	0.00	0.00	$P < 0.05$
Gabon (cattle)	2 (1,632)	6.80% (0.50–16.10%)	115.58	98.97	$P > 0.05$
ITS1-PCR	1	11.20% (2.00–24.60%)	57.15	97.90	$P > 0.05$
Buffy coat microscopy	1	2.90% (2.60–8.40%)	26.64	96.25	$P > 0.05$
T. congolense	2	15.20% (3.60–34.00%)	38.61	97.41	$P > 0.05$
T. vivax	2	3.50% (3.30–10.20%)	16.01	93.75	$P > 0.05$
T. vivax & *T. congolense*	1	2.20% (0.30–4.20%)	0.00	–	$P < 0.05$
Zambia (cattle)	2 (6,660)	5.90% (0.40–11.50%)	408.58	99.66	$P < 0.05$
PCR-RFLP	2	7.50% (1.60–16.50%)	334.33	99.72	$P < 0.05$
Wet smear microscopy	2	3.70% (0.70–8.10%)	73.23	98.64	$P < 0.05$
T. congolense	2	20.50% (1.00–40.50%)	94.59	98.94	$P < 0.05$

Table 2. Continued

Characteristic	No. of studies & total sample size	Prevalence (95% CI)	Measure of Heterogeneity	% of variation (I^2**)	P-value
T. vivax	2	6.70% (4.70–8.80%)	3.85	12.66	$P < 0.05$
T. vivax & *T. congolense*	2	0.70% (0.40–1.10%)	3.18	0.05	$P < 0.05$
Mali (cattle)	1 (1,592)	5.70% (0.60–14.90%)	29.97	96.66	$P < 0.05$
Wet smear microscopy	1	7.70% (0.60–14.90%)	29.97	96.66	$P < 0.05$
T. congolense	1	11.40% (9.20–13.60%)	0.00	0.00	$P < 0.05$
T. vivax	1	4.10% (2.80–5.50%)	0.00	0.00	$P < 0.05$
Senegal (cattle)	1 (5,328)	4.90% (4.10–11.80%)	579.51	99.90	$P > 0.05$
Hematocrite centrifugation technique	1	28.70% (26.20–31.10%)	0.00	0.00	$P < 0.05$
ELISA	1	2.30% (1.80–6.30%)	51.74	98.07	$P > 0.05$
Buffy coat microscopy	1	2.30% (1.50–3.10%)	0.00	–	$P < 0.05$
T. vivax	1	15.50% (10.30–41.30%)	406.97	99.75	$P > 0.05$
T. congolense	1	4.40% (3.30–5.50%)	0.00	–	$P < 0.05$
T. brucei	1	0.20% (0.00–0.50%)	0.00	–	$P > 0.05$
Togo (cattle)	1 (5,649)	3.40% (1.20–5.50%)	38.82	95.73	$P < 0.05$
Hematocrite centrifugation technique	1	3.40% (1.20–5.50%)	38.82	95.73	$P < 0.05$
T. congolense	1	5.50% (4.50–6.60%)	0.00	0.00	$P < 0.05$
T. vivax	1	2.90% (2.20–3.70%)	0.00	0.00	$P < 0.05$
T. brucei	1	1.80% (1.20–2.30%)	0.00	0.00	$P < 0.05$
Overall (camel)	12 (9,967)	18.30% (12.50–20.00%)	1472.70	99.11	$P < 0.05$
Ethiopia (camel)	7 (6,110)	35.20% (25.60–24.80%)	398.78	98.00	$P < 0.05$
CATT	3	52.30% (45.70–58.90%)	0.13	0.02	$P < 0.05$
PCR	2	44.20% (16.90–71.50%)	54.54	95.38	$P < 0.05$
Buffy coat microscopy	3	35.50% (31.90–39.10%)	10.18	87.93	$P < 0.05$
Hematocrit centrifugation	2	30.60% (19.20–42.00%)	0.08	0.34	$P < 0.05$
Wet smear microscopy	2	14.10% (9.50–18.70%)	3.70	72.99	$P < 0.05$
T. evansi	7	12.90% (8.20–17.70%)	359.41	97.59	$P < 0.05$
T. vivax	1	3.40% (2.10–4.80%)	0.00	–	$P < 0.05$
Sudan (camel)	3 (1,984)	12.20% (7.60–16.80%)	125.62	95.36	$P < 0.05$
CATT	2	24.40% (22.20–26.60%)	0.00	–	$P < 0.05$
Species-specific PCR	1	14.10% (8.30–20.00%)	16.93	94.09	$P < 0.05$
ITS1-PCR & CATT	1	9.20% (3.30–15.00%)	0.00	–	$P < 0.05$
KIN-PCR	1	4.90% (3.40–6.40%)	6.12	83.65	$P < 0.05$
Wet smear microscopy	2	3.10% (0.70–5.50%)	0.00	–	$P < 0.05$
T. evansi	3	37.90% (25.40–50.30%)	119.51	96.42	$P < 0.05$
T. vivax	1	17.70% (12.00–23.40%)	1.60	37.59	$P < 0.05$
Kenya (camel)	1 (1,647)	25.80% (2.90–48.70%)	349.95	99.36	$P < 0.05$
PCR	1	45.70% (41.60–49.90%)	0.00	0.00	$P < 0.05$
Nested PCR	1	26.60% (22.90–30.30%)	0.00	0.00	$P < 0.05$
T. evansi	1	25.80% (2.90–49.70%)	349.95	99.36	$P < 0.05$
Nigeria (camel)	1 (226)	5.40% (1.10–9.60%)	2.06	51.43	$P < 0.05$
Buffy coat microscopy	1	5.40% (1.10–9.60%)	2.06	51.43	$P < 0.05$
T. theileri	1	8.00% (3.00–13.00%)	0.00	–	$P < 0.05$
T. evansi	1	3.50% (0.10–6.90%)	0.00	–	$P < 0.05$
Overall pigs	22 (21,087)	15.65% (10.00–22.00%)	4964.73	99.70	$P < 0.05$
Cameroon (pigs)	5 (2,078)	38.00% (27.00–42.00%)	270.38	96.41	$P < 0.05$
Species specific PCR	2	52.40% (45.90–59.00%)	0.00	0.01	$P < 0.05$
PCR	3	31.00% (20.00–41.40%)	83.69	94.00	$P < 0.05$
CATT	2	42.00% (39.00–71.00%)	0.00	0.01	$P < 0.05$
Buffy coat microscopy	3	26.20% (20.50–32.00%)	0.00	–	$P < 0.05$
Wet smear microscopy	3	26.20% (20.50–32.00%)	0.00	–	$P < 0.05$
T. brucei sI	3	43.00% (21.00–66.00%)	82.81	97.11	$P < 0.05$
T. brucei gambiense	2	37.00% (15.00–41.00%)	37.86	97.36	$P < 0.05$
T. vivax	4	36.00% (20.80–51.20%)	78.18	96.02	$P < 0.05$
T. congolense	2	35.50% (31.00–39.00%)	0.06	0.01	$P < 0.05$
Coˆte d'Ivoire (pigs)	4 (685)	31.00% (20.00–41.00%)	24.78	86.76	$P < 0.05$
PCR	3	31.00% (17.00–46.00%)	24.76	91.06	$P < 0.05$
Buffy coat microscopy	1	29.00% (22.30–37.60%)	0.00	0.00	$P < 0.05$
T. congolense	2	41.60% (33.40–49.90%)	0.00	0.00	$P < 0.05$
T. brucei rhodesiense	2	36.50% (28.40–44.60%)	0.00	0.00	$P < 0.05$
Nigeria (pigs)	5 (3,157)	20.60% (11.90–11.30%)	85.62	97.62	$P < 0.05$
Species specific PCR	1	25.40% (2.10–8.80%)	21.35	92.23	$P < 0.05$

Table 2. Continued

Characteristic	No. of studies & total sample size	Prevalence (95% CI)	Measure of Heterogeneity	% of variation (I^2**)	P-value
Buffy coat microscopy	2	14.00% (1.80–6.20%)	0.00	–	$P < 0.05$
Hematocrite centrifugation technique	2	2.10% (0.10–4.20%)	0.00	–	$P < 0.05$
T. vivax	2	8.50% (1.40–15.60%)	0.00	0.00	$P < 0.05$
T. brucei	4	8.40 (0.50–17.20)	80.32	98.60	$P > 0.05$
T. simiae	1	4.60% (3.10–6.20%)	0.00	0.00	$P < 0.05$
T. congolense	1	3.50% (0.50–6.60%)	0.00	0.00	$P < 0.05$
T. congolense & *T. vivax*	1	3.10% (1.80–4.40%)	0.00	0.00	$P < 0.05$
Kenya (pigs)	2 (8,319)	19.10% (8.70–46.80%)	1877.59	99.96	$P > 0.05$
PCR	2	19.10% (8.70–46.80%)	1877.59	99.96	$P > 0.05$
T. brucei rhodesiense	1	47.40% (45.50–49.20%)	0.00	0.00	$P < 0.05$
T. brucei sI	1	6.10% (5.20–7.00%)	0.00	0.00	$P < 0.05$
T. vivax	1	3.80% (3.10–4.80%)	0.00	0.00	$P < 0.05$
Equitorial Guinea (pigs)	1 (159)	18.90% (3.20–34.50%)	2.62	61.77	$P < 0.05$
Species-specific PCR	1	18.90% (3.20–34.50%)	2.62	61.77	$P < 0.05$
T. brucei sI	1	18.90% (3.20–34.50%)	2.62	61.77	$P < 0.05$
Uganda (pigs)	3 (2,734)	7.70% (0.90–14.40%)	135.03	99.07	$P < 0.05$
PCR	1	21.70% (15.40–28.10%)	0.00	0.00	$P < 0.05$
Hematocrite centrifugation technique	2	11.30% (4.10–18.50%)	6.26	84.02	$P < 0.05$
Buffy coat microscopy	1	0.80% (0.10–1.60%)	6.26	84.02	$P < 0.05$
T. brucei	3	14.60% (8.50–20.40%)	21.58	89.36	$P < 0.05$
T. vivax & *T. congolense*	1	1.60% (0.00–3.10%)	0.00	0.00	$P < 0.05$
Zambia (pigs)	2 (2,619)	4.60% (1.60–7.60%)	38.22	90.22	$P < 0.05$
PCR-RFLP	1	6.50% (3.80–9.20%)	0.00	–	$P < 0.05$
KIN-PCR	1	5.20% (1.00–9.40%)	20.46	88.58	$P < 0.05$
T. vivax	2	14.80% (8.80–20.80%)	0.00	–	$P < 0.05$
T. brucei	2	6.70% (2.50–10.90%)	0.00	–	$P < 0.05$
T. congolense	1	3.50% (6.20–0.08%)	15.78	84.63	$P < 0.05$
T. theileri	1	1.50% (0.60–3.50%)	0.00	–	$P > 0.05$
Tanzania (pigs)	1 (840)	3.90% (1.70–6.10%)	11.17	68.22	$P < 0.05$
ITS1-PCR	1	4.20% (1.10–7.20%)	11.09	79.12	$P < 0.05$
PCR	1	3.60% (0.80–6.40%)	0.00	0.00	$P < 0.05$
T. brucei sI	1	9.50% (5.10–14.00%)	0.00	0.00	$P < 0.05$
T. brucei rhodesiense	1	4.80% (1.50–8.00%)	0.00	0.00	$P < 0.05$
T. vivax	1	3.60% (0.80–6.40%)	0.00	0.00	$P < 0.05$
T. godfreyi	1	2.40% (0.10–4.70%)	0.00	0.00	$P < 0.05$
T. simiae	1	1.80% (0.20–3.80%)	0.00	0.00	$P > 0.05$
Overall (sheep)	23 (13,177)	12.76% (10.54–17.85%).	13733.95	99.75	$P < 0.05$
Nigeria (sheep)	8 (6,219)	16.50% (8.10–24.90%)	1328.98	99.49	$P < 0.05$
PCR	1	21.50% (9.80–33.10%)	0.00	–	$P < 0.05$
Hematocrit centrifugation technique	7	5.90% (2.70–9.20%)	0.00	0.08	$P < 0.05$
Buffy coat microscopy	1	5.10% (3.00–7.10%)	1323.68	99.64	$P < 0.05$
T. vivax	8	27.10% (6.20–48.10%)	1031.13	99.39	$P < 0.05$
T. brucei	7	11.50% (4.00–19.10%)	165.94	95.83	$P < 0.05$
T. congolense	6	9.10% (3.20–16.90%)	70.84	97.16	$P < 0.05$
T. theileri	1	8.00% (2.30–13.80%)	0.00	–	$P < 0.05$
T. vivax & *T. congolense*	1	5.50% (1.20–9.70%)	0.00	–	$P < 0.05$
Ethiopia (sheep)	8 (2,553)	17.90% (11.80–24.00%)	135.14	99.40	$P < 0.05$
PCR	2	17.70% (0.30–18.00%)	0.00	0.07	$P < 0.05$
Buffy coat microscopy	4	1.00% (0.50–1.60%)	5.79	0.00	$P < 0.05$
T. vivax	7	18.90% (13.10–24.70%)	1.68	0.00	$P < 0.05$
T. brucei	2	16.40% (15.70–48.60%)	31.75	96.85	$P > 0.05$
T. vivax & *T. congolense*	2	16.70% (15.00–48.30%)	30.54	96.73	$P < 0.05$
T. congolense	3	11.80% (7.90–31.50%)	33.87	99.28	$P > 0.05$
T. evansi	1	1.70% (0.20–3.50%)	0.00	–	$P > 0.05$
Cameroon (Sheep)	3 (1,061)	13.55% (8.70–25.90%)	193.90	99.55	$P < 0.05$
Species-specific PCR	1	25.40% (13.80–47.00%)	26.12	94.47	$P < 0.05$
CATT	1	16.00% (6.00–44.00%)	0.00	0.00	$P < 0.05$
PCR	1	10.80% (3.20–18.30%)	0.00	0.00	$P < 0.05$
Buffy coat microscopy	2	3.80% (0.90–8.40%)	0.00	0.00	$P < 0.05$
T. congolense	1	22.70% (1.40–46.80%)	12.13	91.75	$P > 0.05$
T. brucei sI	2	19.70% (10.30–49.70%)	136.15	99.82	$P > 0.05$
T. vivax	1	8.60% (5.20–12.00%)	0.00	0.00	$P < 0.05$

Table 2. Continued

Characteristic	No. of studies & total sample size	Prevalence (95% CI)	Measure of Heterogeneity	% of variation (I^2**)	P-value
Sudan (sheep)	1	13.10% (10.40–23.70%)	6537.36	99.89	$P < 0.05$
KIN-PCR	1	15.00% (10.40–18.50%)	85.64	98.83	$P < 0.05$
CATT	1	14.00% (8.40–16.40%)	0.00	–	$P < 0.05$
T. vivax	1	13.00% (7.40–15.50%)	0.00	–	$P < 0.05$
T. evansi	1	12.50% (7.50–15.50%)	33.83	97.04	$P < 0.05$
Equitorial Guinea (sheep)	1 (872)	12.20% (6.40–30.80%)	131.94	99.54	$P > 0.05$
Species-specific PCR	1	12.20% (6.40–30.80%)	0.00	0.00	$P > 0.05$
T. brucei sI	1	41.30% (31.70–47.80%)	0.00	0.00	$P < 0.05$
T. congolense	1	3.70% (1.20–6.20%)	0.00	0.00	$P < 0.05$
T. vivax	1	2.80% (0.60–4.90%)	0.00	0.00	$P < 0.05$
T. gambiense	1	1.80% (0.10–3.60%)	0.00	0.00	$P < 0.05$
Uganda (sheep)	1	5.96% (3.50–7.50%)	0.00	–	$P < 0.05$
PCR	1	5.96% (3.50–7.50%)	0.00	–	$P < 0.05$
T. brucei	1	5.96% (3.50–7.50%)	0.00	–	$P < 0.05$
Coˆte d'Ivoire (sheep)	1 (960)	5.30% (3.60–7.00%)	7.34	28.03	$P < 0.05$
PCR	1	5.70% (3.10–8.30%)	7.20	61.20	$P < 0.05$
Buffy coat microscopy	1	4.70% (1.70–7.70%)	0.00	0.00	$P < 0.05$
T. congolense & *T. vivax* + *T. brucei* rhodesiense	1	10.90% (6.50–15.40%)	0.00	0.00	$P < 0.05$
T. vivax	1	4.70% (1.70–7.70%)	0.00	0.00	$P < 0.05$
T. brucei rhodesiense	1	4.20% (1.30–7.00%)	0.00	0.00	$P < 0.05$
Species-specific PCR	1	15.00% (0.60–30.60%)	0.00	0.00	$P > 0.05$
CATT	1	30.00% (9.00–50.00%)	0.00	0.00	$P < 0.05$
PCR	1	4.20% (0.50–8.90%)	1.07	6.76	$P < 0.05$
Buffy coat microscopy	1	15.00% (0.60–30.60%)	0.00	0.00	$P > 0.05$
T. brucei sI	1	21.10% (6.70–35.50%)	1.33	25.00	$P < 0.05$
T. congolense	2	10.80% (3.90–17.70%)	0.91	0.00	$P < 0.05$
T. vivax	1	2.70% (2.50–7.90%)	0.00	0.00	$P > 0.05$
Overall (goats)	30 (40,287	11.85% (9.85–17.25%)	10508.11	99.95	$P < 0.05$
Nigeria (goats)	9 (12,889)	18.20% (8.80–27.60%)	4040.99	99.83	$P < 0.05$
ELISA	2	55.10% (52.00–58.30%)	0.00	0.00	$P < 0.05$
PCR	1	18.20% (15.30–21.10%)	0.17	0.00	$P < 0.05$
Hematocrit centrifugation technique	7	16.40% (5.20–27.60%)	2969.55	99.89	$P < 0.05$
T. congolense	7	23.00% (5.20–40.90%)	2940.13	99.74	$P < 0.05$
T. vivax	6	22.70% (2.50–42.90%)	833.49	99.62	$P < 0.05$
T. brucei	3	9.80% (1.70–21.30%)	140.36	99.35	$P < 0.05$
T. vivax & *T. brucei*	1	12.50% (10.80–14.20%)	0.00	–	$P < 0.05$
T. vivax & *T. congolense*	1	4.20% (3.10–5.20%)	0.00	–	$P < 0.05$
T. theileri	1	2.80% (0.40–5.20%)	0.00	–	$P < 0.05$
Ethiopia (goats)	8 (6,052)	11.70% (5.50–28.80%)	1513.74	99.87	$P > 0.05$
PCR	2	25.00% (3.10–53.20%)	0.55	0.28	$P < 0.05$
Hematocrit centrifugation	2	3.10% (1.60–4.60%)	1019.78	99.82	$P < 0.05$
Buffy coat microscopy	3	1.40% (0.30–2.40)	12.54	0.01	$P < 0.05$
Wet smear microscopy	2	0.50% (0.20–0.90%)	5.45	0.00	$P < 0.05$
T. vivax	7	23.10% (19.80–65.90%)	1194.61	99.95	$P > 0.05$
T. congolense	3	20.00% (4.30–35.70%)	154.73	124.31	$P > 0.05$
T. brucei	2	4.20% (3.60–12.00%)	50.85	98.03	$P < 0.05$
T. evansi	1	3.80% (1.50–12.00%)	0.00	–	$P < 0.05$
T. vivax & *T. congolense*	2	2.50% (0.80–5.90%)	12.94	92.27	$P > 0.05$
Equitorial Guinea (goats)	1 (1,848)	10.20% (1.20–19.30%)	395.86	99.86	$P > 0.05$
Species-specific PCR	1	11.70% (5.50–28.80%)	395.86	99.86	$P > 0.05$
T. brucei sI	1	25.50% (16.00–66.90%)	81.08	98.77	$P > 0.05$
T. congolense	1	6.40% (4.10–8.60%)	0.00	0.00	$P < 0.05$
T. vivax	1	0.90% (0.00–1.70%)	0.00	0.00	$P < 0.05$
T. brucei gambiense	1	0.70% (0.10–1.40%)	0.00	0.00	$P < 0.05$
Cameroon (goats)	3 (1,140)	8.90% (8.70–48.10%)	416.94	99.28	$P < 0.05$
CATT	1	9.40% (0.50–19.30%)	0.00	0.00	$P < 0.05$
Species-specific PCR	2	6.70% (6.80–16.60%)	70.03	96.94	$P < 0.05$
PCR	1	6.70% (6.80–16.60%)	0.00	0.00	$P < 0.05$
Buffy coat microscopy	2	19.50% (11.20–27.90%)	0.00	–	$P < 0.05$
T. brucei sI	2	43.00% (3.20–89.20%)	112.13	98.58	$P > 0.05$
T. congolense	2	31.80% (2.50–66.10%)	50.92	98.04	$P > 0.05$

Table 2. Continued

Characteristic	No. of studies & total sample size	Prevalence (95% CI)	Measure of Heterogeneity	% of variation (I^2**)	*P*-value
T. vivax	3	18.20% (13.50–22.80%)	0.00	–	$P < 0.05$
T. simiae	1	0.80% (0.03–1.80%)	0.00	–	$P > 0.05$
Zambia (goats)	3 (4,406)	8.80% (1.80–15.70%)	57.06	96.90	$P < 0.05$
LAMP-PCR	1	10.60% (2.20–19.10%)	40.61	96.58	$P < 0.05$
PCR-RFLP	1	3.30% (1.40–5.20%)	0.00	–	$P < 0.05$
T. brucei	2	19.40% (15.70–23.20%)	0.00	–	$P < 0.05$
T. vivax	2	7.30% (4.90–9.80%)	0.00	–	$P < 0.05$
T. congolense	2	4.30% (2.20–6.40%)	2.11	52.70	$P < 0.05$
Sudan (goats)	1 (992)	6.80% (3.40–10.10%)	1719.35	99.82	$P < 0.05$
CATT	1	13.70% (9.40–18.00%)	0.00	–	$P < 0.05$
KIN-PCR	1	4.90% (10.85–15.85%)	0.39	0.01	$P < 0.05$
T. vivax	1	8.65% (6.85–10.85%)	0.00	–	$P < 0.05$
T. evansi	1	9.50% (8.90–10.55%)	539.42	99.81	$P > 0.05$
Kenya (goats)	1 (8,319)	6.50% (3.40–16.50%)	494.10	99.88	$P > 0.05$
PCR	1	6.50% (3.40–16.50%)	494.10	99.88	$P > 0.05$
T. brucei rhodesiense	1	16.70% (15.30–18.10%)	0.00	0.00	$P < 0.05$
T. vivax	1	2.30% (1.70–2.80%)	0.00	0.00	$P < 0.05$
T. brucei sI	1	0.70% (0.40–1.00%)	0.00	0.00	$P < 0.05$
Coˆte d'Ivoire (goats)	2 (680)	2.30% (0.70–3.90%)	8.76	53.51	$P < 0.05$
PCR	1	2.80% (0.50–5.00%)	8.68	66.22	$P < 0.05$
Buffy coat microscopy	1	1.50% (0.60–3.50%)	0.00	0.00	$P > 0.05$
T. congolense & *T. vivax*	2	6.60% (2.40–10.80%)	0.00	0.00	$P < 0.05$
T. congolense	1	3.70% (0.50–6.80%)	0.00	0.00	$P < 0.05$
T. brucei rhodesiense	1	2.00% (0.30–4.70%)	0.00	0.00	$P < 0.05$
Uganda (goats)	3 (4,501)	1.40% (0.40–3.20%)	40.24	99.15	$P > 0.05$
PCR	1	3.20% (1.70–4.70%)	0.00	0.00	$P < 0.05$
Buffy coat microscopy	2	0.20% (0.00–0.30%)	0.00	0.18	$P < 0.05$
T. brucei	3	7.90% (4.90–10.90%)	0.00	0.00	$P < 0.05$
T. theileri	1	1.60% (1.30–4.50%)	13.65	92.67	$P < 0.05$
T. vivax & *T. congolense*	1	0.20% (0.20–0.50%)	0.00	0.00	$P > 0.05$
Overall (dogs)	5 (1,802)	3.71% (2.54–6.78%)	48.79	85.53	$P < 0.05$
Cameroon (dogs)	3	11.20% (4.10–18.20%)	10.70	53.09	$P < 0.05$
CATT	3	30.00% (9.90–50.10%)	0.00	–	$P < 0.05$
Species-specific PCR	2	15.00% (6.00–30.60%)	1.00	6.76	$P < 0.05$
T. brucei sI	3	21.10% (6.70–35.60%)	1.33	25.00	$P < 0.05$
T. congolense	2	10.80% (3.90–17.70%)	0.91	0.00	$P < 0.05$
T. vivax	1	2.70% (2.50–7.90%)	0.00	–	$P > 0.05$
Uganda (dogs)	1 (226)	7.60% (1.00–16.20%)	6.20	83.88	$P > 0.05$
PCR	1	12.40% (6.30–18.50%)	0.00	–	$P < 0.05$
Hematocrite centrifugation technique	1	3.50% (0.10–6.90%)	0.00	–	$P < 0.05$
T. brucei	1	7.60% (1.00–16.20%)	6.20	83.88	$P > 0.05$
Zambia (dogs)	1 (1,422)	1.70% (0.60–2.80%)	14.75	69.88	$P < 0.05$
LAMP-PCR	1	5.50% (2.60–8.40%)	5.74	30.73	$P < 0.05$
Wet smear microscopy	1	1.10% (0.40–1.80%)	0.00	–	$P < 0.05$
T. brucei rhodesiense	1	2.50% (0.50–4.50%)	0.00	–	$P < 0.05$
T. congolense	1	1.30% (0.20–2.70%)	0.00	–	$P > 0.05$
T. brucei	1	0.80% (0.30–2.00%)	0.00	–	$P > 0.05$
Overall (donkey)	5 (3,195)	3.69% (2.54–6.85%)	43.65	60.33	$P < 0.05$
Uganda (donkey)	2	17.10% (6.30–40.60%)	15.57	93.58	$P > 0.05$
ITS1-PCR	2	17.10% (6.30–40.60%)	15.57	93.58	$P > 0.05$
T. congolense	1	29.60% (19.00–40.20%)	0.00	–	$P < 0.05$
T. vivax	1	5.60% (0.30–11.00%)	0.00	–	$P < 0.05$
Ethiopia (donkey)	2 (1,014)	3.50% (2.20–4.80%)	4.04	24.66	$P < 0.05$
PCR	1	6.00% (0.90–11.00%)	0.00	0.00	$P < 0.05$
Buffy coat microscopy	1	3.30% (2.60–4.60%)	3.00	25.42	$P < 0.05$
T. evansi	1	6.00% (0.90–11.00%)	0.00	0.00	$P < 0.05$
T. vivax	1	5.20% (2.70–7.60%)	0.00	0.00	$P < 0.05$
T. brucei	1	2.60% (0.80–4.30%)	0.00	0.00	$P < 0.05$
Sudan (donkey)	1 (2,036)	2.50% (1.40–3.60%)	9.08	63.39	$P < 0.05$
ITS1-PCR	1	2.50% (1.40–3.60%)	9.08	63.39	$P < 0.05$
T. vivax	1	3.30% (1.80–4.90)	0.00	–	$P < 0.05$
T. brucei	1	3.10% (1.60–4.70%)	0.00	–	$P < 0.05$
T. simiae	1	2.90% (1.50–4.40%)	0.00	–	$P < 0.05$
T. congolense	1	1.20% (0.20–2.10%)	0.00	–	$P < 0.05$

Table 3. Studies included in the meta-analysis

Region	Country	author	year	Animal_species	denom	overall_num	Trypanosoma_species	diagnostic_tool
South Africa	South Africa	Mamabolo	2009	Cattle	673	63	T. congolense	Species-specific PCR
South Africa	South Africa	Mamabolo	2009	Cattle	673	30	T. vivax	Species-specific PCR
South Africa	South Africa	Mamabolo	2009	Cattle	673	5	T. vivax & T. congolense	Species-specific PCR
South Africa	South Africa	Gillingwater	2010	Cattle	473	31	T. congolense	haematocrit centrifugation technique (HCT)
South Africa	South Africa	Gillingwater	2010	Cattle	473	236	T. congolense	Species-specific PCR
South Africa	Zambia	Lisulo	2014	Dogs	237	13	T. vivax	microscopy
South Africa	Zambia	Lisulo	2014	Dogs	237	3	T. congolense	LAMP-PCR
South Africa	Zambia	Lisulo	2014	Dogs	237	2	T. brucei	LAMP-PCR
South Africa	Zambia	Lisulo	2014	Dogs	237	6	T. brucei rhodesiense	LAMP-PCR
South Africa	Zambia	Lisulo	2014	Dogs	237	1	T. congolense & T. brucei	LAMP-PCR
South Africa	Zambia	Lisulo	2014	Dogs	237	5	T. congolense & T. brucei rhodesiense	LAMP-PCR
South Africa	Zambia	Nyimba	2015	Goats	422	0	T. brucei	microscopy
South Africa	Zambia	Nyimba	2015	Goats	422	82	T. brucei	LAMP-PCR
South Africa	Zambia	Nyimba	2015	Goats	422	31	T. vivax	LAMP-PCR
South Africa	Zambia	Nyimba	2015	Goats	422	23	T. congolense	LAMP-PCR
South Africa	Zambia	Ahmadu	2002	Goats	120	0	T. vivax	haematocrit centrifugation technique (HCT)
South Africa	Zambia	Ahmadu	2002	Goats	120	0	T. brucei	haematocrit centrifugation technique (HCT)
South Africa	Zambia	Ahmadu	2002	Goats	120	0	T. congolense	haematocrit centrifugation technique (HCT)
South Africa	Zambia	Ahmadu	2002	Goats	120	0	T. vivax	PCR
South Africa	Zambia	Ahmadu	2002	Goats	120	0	T. brucei	PCR
South Africa	Zambia	Ahmadu	2002	Goats	120	0	T. congolense	PCR
South Africa	Zambia	simukoko	2007	Cattle	734	224	T. congolense	PCR-RFLP
South Africa	Zambia	simukoko	2007	Cattle	734	18	T. vivax	PCR-RFLP
South Africa	Zambia	simukoko	2007	Cattle	734	4	T. vivax & T. congolense	PCR-RFLP
South Africa	Zambia	simukoko	2007	Goats	333	11	T. congolense	PCR-RFLP
South Africa	Zambia	simukoko	2007	Goats	333	0	T. vivax	PCR-RFLP
South Africa	Zambia	simukoko	2007	Goats	333	0	T. vivax & T. congolense	PCR-RFLP
South Africa	Zambia	simukoko	2007	Pigs	324	21	T. congolense	PCR-RFLP
South Africa	Zambia	simukoko	2007	Pigs	324	0	T. vivax	PCR-RFLP
South Africa	Zambia	simukoko	2007	Pigs	324	0	T. vivax & T. congolense	PCR-RFLP
South Africa	Zambia	simukoko	2007	Cattle	734	78	T. congolense	microscopy
South Africa	Zambia	simukoko	2007	Cattle	734	16	T. vivax	microscopy
South Africa	Zambia	simukoko	2007	Cattle	734	5	T. vivax & T. congolense	microscopy
South Africa	Zambia	simukoko	2007	Goats	333	0	T. congolense	microscopy
South Africa	Zambia	simukoko	2007	Goats	333	0	T. vivax	microscopy
South Africa	Zambia	simukoko	2007	Goats	333	0	T. vivax & T. congolense	microscopy
South Africa	Zambia	simukoko	2007	Pigs	324	3	T. congolense	microscopy
South Africa	Zambia	simukoko	2007	Pigs	324	0	T. vivax	microscopy
South Africa	Zambia	simukoko	2007	Pigs	324	0	T. vivax & T. congolense	microscopy
South Africa	Zambia	Mwandiringana	2012	Pigs	135	3	T. vivax	KIN-PCR
South Africa	Zambia	Mwandiringana	2012	Pigs	135	9	T. brucei	KIN-PCR
South Africa	Zambia	Mwandiringana	2012	Pigs	135	5	T. congolense	KIN-PCR
South Africa	Zambia	Mwandiringana	2012	Pigs	135	20	T. vivax	KIN-PCR
South Africa	Zambia	Mwandiringana	2012	Pigs	135	2	T. theileri	KIN-PCR
South Africa	Zambia	Mbewe	2015	Cattle	564	9	T. vivax	microscopy

Table 3. Continued

Region	Country	author	year	Animal_species	denom	overall_num	Trypanosoma_species	diagnostic_tool
South Africa	Zambia	Mbewe	2015	Cattle	564	19	T. vivax	PCR-RFLP
South Africa	Zambia	Mbewe	2015	Cattle	564	9	T. vivax & T. congolense	PCR-RFLP
South Africa	Zambia	Mbewe	2015	Cattle	564	38	T. theileri	PCR-RFLP
Western Africa	Mali	Mungube	2012	Cattle	796	33	T. vivax	microscopy
Western Africa	Mali	Mungube	2012	Cattle	796	91	T. congolense	microscopy
Western Africa	Ghana	Mahama	2004	Cattle	505	44	T. vivax	buffy coat-microscopy
Western Africa	Ghana	Mahama	2004	Cattle	505	8	T. congolense	PCR
Western Africa	Ghana	Mahama	2004	Cattle	505	5	T. brucei	PCR
Western Africa	Ghana	Mahama	2004	Cattle	505	2	T. vivax & T. congolense	PCR
Western Africa	Ghana	Mahama	2004	Cattle	505	1	T. vivax & T. brucei	PCR
Western Africa	Ghana	Mahama	2004	Cattle	505	1	T. congolense & T. brucei	PCR
Western Africa	Ghana	Nakayima	2012	Cattle	146	54	T. congolense	ITS1 PCR
Western Africa	Ghana	Nakayima	2012	Cattle	146	24	T. congolense & T. vivax + T. brucei	ITS1 PCR
Western Africa	Ghana	Nakayima	2012	Pigs	248	109	T. congolense	ITS1 PCR
Western Africa	Ghana	Nakayima	2012	Pigs	248	206	T. congolense & T. vivax + T. brucei	ITS1 PCR
Western Africa	Nigeria	Fayemi	2003	Goats	967	533	T. congolense	ELISA
Western Africa	Nigeria	Balogun	2021	Goats	21	3	T. congolense	PCR
Western Africa	Nigeria	Balogun	2021	Goats	21	4	T. vivax	PCR
Western Africa	Nigeria	Balogun	2021	Sheep	21	1	T. brucei	PCR
Western Africa	Nigeria	Balogun	2021	Sheep	21	1	T. vivax	microscopy
Western Africa	Nigeria	Balogun	2021	Sheep	21	0	T. brucei	microscopy
Western Africa	Nigeria	Balogun	2021	Sheep	37	23	T. vivax	haematocrit centrifugation technique (HCT)& Buffy coat
Western Africa	Nigeria	Balogun	2021	Sheep	37	7	T. brucei	haematocrit centrifugation technique (HCT)& Buffy coat
Western Africa	Nigeria	Balogun	2021	Sheep	37	6	T. congolense	haematocrit centrifugation technique (HCT)& Buffy coat
Western Africa	Nigeria	Ahmed	2007	Cattle	395	254	T. vivax	haematocrit centrifugation technique (HCT)& Buffy coat
Western Africa	Nigeria	Ahmed	2007	Cattle	395	71	T. brucei	haematocrit centrifugation technique (HCT)& Buffy coat
Western Africa	Nigeria	Ahmed	2007	Cattle	395	67	T. congolense	haematocrit centrifugation technique (HCT)& Buffy coat
Central Africa	Cameroon	mpouam	2011	Cattle	330	9	T. congolense	buffy coat-microscopy
Central Africa	Cameroon	mpouam	2011	Cattle	330	3	T. vivax	buffy coat-microscopy
Central Africa	Cameroon	mpouam	2011	Cattle	330	8	T. brucei	buffy coat-microscopy
Central Africa	Cameroon	mpouam	2011	Cattle	330	0	T. vivax & T. congolense	buffy coat-microscopy
Central Africa	Cameroon	mpouam	2011	Cattle	330	3	T. vivax & T. brucei	buffy coat-microscopy
Central Africa	Cameroon	mpouam	2011	Cattle	330	1	T. congolense & T. brucei	buffy coat-microscopy
Central Africa	Cameroon	mpouam	2011	Cattle	330	34	T. congolense	ELISA
Central Africa	Cameroon	mpouam	2011	Cattle	330	48	T. vivax	ELISA
Central Africa	Cameroon	mpouam	2011	Cattle	330	0	T. brucei	ELISA
Central Africa	Cameroon	mpouam	2011	Cattle	330	0	T. vivax & T. congolense	ELISA
Central Africa	Cameroon	mpouam	2011	Cattle	330	0	T. vivax & T. brucei	ELISA
Central Africa	Cameroon	mpouam	2011	Cattle	330	0	T. congolense & T. brucei	ELISA
Central Africa	Cameroon	Ngomtcho	2017	Cattle	392	137	T. congolense	nested PCR
Central Africa	Cameroon	Ngomtcho	2017	Cattle	392	102	T. vivax	nested PCR
Central Africa	Cameroon	Ngomtcho	2017	Cattle	392	67	T. brucei	nested PCR
Central Africa	Cameroon	Ngomtcho	2017	Cattle	392	67	T. theileri	nested PCR
Central Africa	Cameroon	Ngomtcho	2017	Cattle	392	1	T. grayi	nested PCR
Central Africa	Cameroon	Mamoudou	2015	Cattle	223	18	T. congolense	buffy coat-microscopy

Table 3. Continued

Region	Country	author	year	Animal_species	denom	overall_num	Trypanosoma_species	diagnostic_tool
Central Africa	Cameroon	Mamoudou	2015	Cattle	223	3	T. vivax	buffy coat-microscopy
Central Africa	Cameroon	Mamoudou	2015	Cattle	223	1	T. brucei	buffy coat-microscopy
Central Africa	Cameroon	Mamoudou	2016	Cattle	866	52	T. vivax	buffy coat-microscopy
Central Africa	Cameroon	Mamoudou	2016	Cattle	866	11	T. congolense	buffy coat-microscopy
Central Africa	Cameroon	Mamoudou	2016	Cattle	866	8	T. brucei	buffy coat-microscopy
Central Africa	Cameroon	Mamoudou	2000	Cattle	170	6	T. vivax	buffy coat-microscopy
Central Africa	Cameroon	Mamoudou	2000	Cattle	170	52	T. congolense	buffy coat-microscopy
Central Africa	Cameroon	Mamoudou	2000	Cattle	170	1	T. brucei	buffy coat-microscopy
Western Africa	Burkina Faso	Silbermayr	2013	Cattle	368	34	T. vivax	PCR
Western Africa	Burkina Faso	Silbermayr	2013	Cattle	368	9	T. congolense	PCR
Western Africa	Burkina Faso	Silbermayr	2013	Cattle	368	3	T. brucei	PCR
Western Africa	Burkina Faso	Silbermayr	2013	Cattle	368	9	T. vivax	PCR
Western Africa	Burkina Faso	Silbermayr	2013	Cattle	368	33	T. congolense	PCR
Western Africa	Burkina Faso	Silbermayr	2013	Cattle	368	0	T. brucei	PCR
Western Africa	Burkina Faso	Bengaly	2012	Cattle	1,041	24	T. vivax	buffy coat-microscopy
Western Africa	Burkina Faso	Bengaly	2012	Cattle	1,041	31	T. congolense	buffy coat-microscopy
Western Africa	Burkina Faso	Bengaly	2012	Cattle	1,041	0	T. brucei	buffy coat-microscopy
Western Africa	Burkina Faso	Bengaly	2012	Cattle	1,041	223	T. vivax	ELISA
Western Africa	Burkina Faso	Bengaly	2012	Cattle	1,041	181	T. congolense	ELISA
Western Africa	Burkina Faso	Bengaly	2012	Cattle	1,041	21	T. brucei	ELISA
Western Africa	Burkina Faso	Dayo	2010	Cattle	363	243	T. vivax	buffy coat-microscopy
Western Africa	Burkina Faso	Dayo	2010	Cattle	363	87	T. congolense	buffy coat-microscopy
Western Africa	Burkina Faso	Dayo	2010	Cattle	363	36	T. vivax & T. congolense	buffy coat-microscopy
Western Africa	Nigeria	Joshua	2008	Camel	113	9	T. theileri	buffy coat-microscopy
Western Africa	Nigeria	Joshua	2008	Camel	113	4	T. evansi	buffy coat-microscopy
Western Africa	Nigeria	Ukpai	2017	Cattle	115	7	T. vivax	buffy coat-microscopy
Western Africa	Nigeria	Ukpai	2017	Cattle	115	23	T. brucei	buffy coat-microscopy
Western Africa	Nigeria	Wayo	2017	Sheep	110	18	T. congolense	haematocrit centrifugation technique (HCT)& Buffy coat
Western Africa	Nigeria	Wayo	2017	Sheep	110	13	T. brucei	haematocrit centrifugation technique (HCT)& Buffy coat
Western Africa	Nigeria	Wayo	2017	Sheep	110	8	T. vivax	haematocrit centrifugation technique (HCT)& Buffy coat
Western Africa	Nigeria	Wayo	2017	Sheep	110	6	T. vivax & T. congolense	haematocrit centrifugation technique (HCT)& Buffy coat
Western Africa	Nigeria	Ibn Zubairu	2013	Cattle	240	10	T. congolense	buffy coat-microscopy
Western Africa	Nigeria	Ibn Zubairu	2013	Cattle	240	10	T. congolense	buffy coat-microscopy
Western Africa	Nigeria	Fasanmi	2014	Cattle	320	10	T. vivax	microscopy
Western Africa	Nigeria	Fasanmi	2014	Cattle	320	5	T. brucei	microscopy
Western Africa	Nigeria	Fajinmi	2007	Cattle	500	6	T. vivax	haematocrit centrifugation technique (HCT)
Western Africa	Nigeria	Fajinmi	2007	Cattle	500	1	T. congolense	haematocrit centrifugation technique (HCT)
Western Africa	Nigeria	Fajinmi	2007	Cattle	500	2	T. brucei	haematocrit centrifugation technique (HCT)
Western Africa	Nigeria	Fajinmi	2007	Cattle	500	22	T. brucei	Species-specific PCR
Western Africa	Nigeria	Enwezor	2012	Cattle	395	14	T. vivax	buffy coat-microscopy
Western Africa	Nigeria	Enwezor	2012	Cattle	395	1	T. congolense	buffy coat-microscopy
Western Africa	Nigeria	Enwezor	2009	Cattle	1293	105	T. vivax	buffy coat-microscopy
Western Africa	Nigeria	Enwezor	2009	Cattle	1,293	2	T. congolense	buffy coat-microscopy
Western Africa	Nigeria	Enwezor	2009	Cattle	1,293	1	T. brucei	buffy coat-microscopy
Western Africa	Nigeria	Enwezor	2009	Cattle	1,293	1	T. vivax & T. congolense	buffy coat-microscopy

Table 3. Continued

Region	Country	author	year	Animal_species	denom	overall_num	Trypanosoma_species	diagnostic_tool
Western Africa	Nigeria	Abenga	2015	Cattle	214	13	T. vivax	haematocrit centrifugation technique (HCT)& Buffy coat
Western Africa	Nigeria	Abenga	2015	Cattle	214	8	T. brucei	haematocrit centrifugation technique (HCT)& Buffy coat
Western Africa	Nigeria	Abenga	2015	Cattle	214	6	T. vivax & T. brucei	haematocrit centrifugation technique (HCT)& Buffy coat
Western Africa	Nigeria	Abenga	2015	Cattle	214	1	T. congolense & T. brucei	haematocrit centrifugation technique (HCT)& Buffy coat
Western Africa	Nigeria	shamaki	2009	Cattle	68	6	T. vivax	haematocrit centrifugation technique (HCT)
Western Africa	Nigeria	shamaki	2009	Sheep	57	5	T. vivax	haematocrit centrifugation technique (HCT)
Western Africa	Nigeria	shamaki	2009	Goats	16	2	T. vivax	haematocrit centrifugation technique (HCT)
Western Africa	Nigeria	shamaki	2009	Donkey	3	1	T. vivax	haematocrit centrifugation technique (HCT)
Western Africa	Nigeria	shamaki	2009	Pigs	59	5	T. vivax	haematocrit centrifugation technique (HCT)
Western Africa	Nigeria	Anene	2011	Pigs	300	12	T. brucei	buffy coat-microscopy
Western Africa	Nigeria	Ogunsanmi	2000	Pigs	189	51	T. brucei	ELISA
Western Africa	Nigeria	Ogunsanmi	2000	Pigs	189	4	T. brucei	haematocrit centrifugation technique (HCT)& Buffy coat
Western Africa	Nigeria	Ademola	2013	Cattle	141	5	T. brucei	microscopy
Western Africa	Nigeria	Ademola	2013	Cattle	141	3	T. vivax	microscopy
Western Africa	Nigeria	Ademola	2013	sheep, goats	99	1	T. vivax	microscopy
Western Africa	Nigeria	Ademola	2013	sheep, goats	99	2	T. brucei	microscopy
Western Africa	Nigeria	Ademola	2013	Pigs	142	5	T. simiae	microscopy
Western Africa	Nigeria	Ademola	2013	Pigs	142	2	T. brucei	microscopy
Western Africa	Nigeria	Fayemi	2011	Goats	1,414	825	T. congolense	haematocrit centrifugation technique (HCT)& Buffy coat
Western Africa	Nigeria	Fayemi	2011	Goats	1,414	236	T. vivax	haematocrit centrifugation technique (HCT)& Buffy coat
Western Africa	Nigeria	Fayemi	2011	Goats	1,414	118	T. brucei	haematocrit centrifugation technique (HCT)& Buffy coat
Western Africa	Nigeria	Fayemi	2011	Goats	1,414	59	T. vivax & T. congolense	haematocrit centrifugation technique (HCT)& Buffy coat
Western Africa	Nigeria	Fayemi	2011	Goats	1,414	177	T. vivax & T. brucei	haematocrit centrifugation technique (HCT)& Buffy coat
Western Africa	Nigeria	Fasanmi	2014	Cattle	320	213	T. vivax	buffy coat-microscopy
Western Africa	Nigeria	Fasanmi	2014	Cattle	320	107	T. brucei	buffy coat-microscopy
Western Africa	Nigeria	Ameen	2008	Sheep	940	45	T. congolense	haematocrit centrifugation technique (HCT)
Western Africa	Nigeria	Ameen	2008	Sheep	940	0	T. vivax	haematocrit centrifugation technique (HCT)
Western Africa	Nigeria	Ameen	2008	Sheep	940	0	T. brucei	haematocrit centrifugation technique (HCT)
Western Africa	Nigeria	Ameen	2008	Goats	675	124	T. congolense	haematocrit centrifugation technique (HCT)
Western Africa	Nigeria	Ameen	2008	Goats	675	0	T. vivax	haematocrit centrifugation technique (HCT)
Western Africa	Nigeria	Ameen	2008	Goats	675	0	T. brucei	haematocrit centrifugation technique (HCT)
Western Africa	Nigeria	Ameen	2008	Cattle	465	18	T. congolense	haematocrit centrifugation technique (HCT)
Western Africa	Nigeria	Ameen	2008	Cattle	465	0	T. vivax	haematocrit centrifugation technique (HCT)
Western Africa	Nigeria	Ameen	2008	Cattle	465	0	T. brucei	haematocrit centrifugation technique (HCT)
Western Africa	Nigeria	samdi	2008	Goats	320	3	T. vivax	haematocrit centrifugation technique (HCT)& Buffy coat
Western Africa	Nigeria	samdi	2008	Goats	320	1	T. congolense	haematocrit centrifugation technique (HCT)& Buffy coat
Western Africa	Nigeria	samdi	2008	Goats	320	2	T. brucei	haematocrit centrifugation technique (HCT)& Buffy coat
Western Africa	Nigeria	samdi	2008	Sheep	209	2	T. vivax	haematocrit centrifugation technique (HCT)& Buffy coat
Western Africa	Nigeria	samdi	2008	Sheep	209	2	T. congolense	haematocrit centrifugation technique (HCT)& Buffy coat
Western Africa	Nigeria	samdi	2008	Sheep	209	1	T. brucei	haematocrit centrifugation technique (HCT)& Buffy coat
Western Africa	Nigeria	Ezebuiro	2008	Cattle	300	180	T. vivax	haematocrit centrifugation technique (HCT)& Buffy coat
Western Africa	Nigeria	Ezebuiro	2008	Cattle	300	81	T. brucei	haematocrit centrifugation technique (HCT)& Buffy coat
Western Africa	Nigeria	Ezebuiro	2008	Cattle	300	39	T. congolense	haematocrit centrifugation technique (HCT)& Buffy coat
Western Africa	Nigeria	Ezebuiro	2008	Goats	300	213	T. vivax	haematocrit centrifugation technique (HCT)& Buffy coat
Western Africa	Nigeria	Ezebuiro	2008	Goats	300	63	T. brucei	haematocrit centrifugation technique (HCT)& Buffy coat

Table 3. Continued

Region	Country	author	year	Animal_species	denom	overall_num	Trypanosoma_species	diagnostic_tool
Western Africa	Nigeria	Ezebuiro	2008	Goats	300	21	T. congolense	haematocrit centrifugation technique (HCT)& Buffy coat
Western Africa	Nigeria	Ezebuiro	2008	Sheep	300	210	T. vivax	haematocrit centrifugation technique (HCT)& Buffy coat
Western Africa	Nigeria	Ezebuiro	2008	Sheep	300	90	T. brucei	haematocrit centrifugation technique (HCT)& Buffy coat
Western Africa	Nigeria	Ezebuiro	2008	Sheep	300	0	T. congolense	haematocrit centrifugation technique (HCT)& Buffy coat
Western Africa	Nigeria	Idehen	2018	Cattle	361	13	T. vivax	buffy coat-microscopy
Western Africa	Nigeria	Idehen	2018	Cattle	361	13	T. brucei	buffy coat-microscopy
Western Africa	Nigeria	Idehen	2018	Sheep	101	6	T. vivax	buffy coat-microscopy
Western Africa	Nigeria	Idehen	2018	Sheep	101	6	T. brucei	buffy coat-microscopy
Western Africa	Nigeria	Anyanwu	2016	Sheep	87	7	T. theileri	microscopy
Western Africa	Nigeria	Anyanwu	2016	Goats	178	5	T. theileri	microscopy
Western Africa	Nigeria	omoogun	2000	Cattle	21	3	T. vivax	haematocrit centrifugation technique (HCT)
Western Africa	Nigeria	omoogun	2000	Cattle	10	0	T. vivax	haematocrit centrifugation technique (HCT)
Western Africa	Nigeria	omoogun	2000	Goats	14	0	T. vivax	haematocrit centrifugation technique (HCT)
Western Africa	Nigeria	Majekodunmi	2013	Cattle	7,143	1,979	T. congolense	Species-specific PCR
Western Africa	Nigeria	Majekodunmi	2013	Cattle	7,143	1,907	T. vivax	Species-specific PCR
Western Africa	Nigeria	Majekodunmi	2013	Cattle	7,143	229	T. brucei	Species-specific PCR
Western Africa	Nigeria	Takeet	2013	Cattle	411	200	T. congolense	PCR
Western Africa	Nigeria	Takeet	2013	Cattle	411	107	T. vivax	PCR
Western Africa	Nigeria	Takeet	2013	Cattle	411	18	T. brucei	PCR
Western Africa	Nigeria	Takeet	2013	Cattle	411	57	T. evansi	PCR
Western Africa	Nigeria	Takeet	2013	Cattle	411	57	T. vivax & T. congolense	PCR
Western Africa	Nigeria	Takeet	2013	Cattle	411	6	T. evansi & T. vivax & T. congolense	PCR
Western Africa	Nigeria	Takeet	2013	Cattle	411	6	T. vivax	microscopy
Western Africa	Nigeria	Kalu	2001	Sheep	304	179	T. vivax	haematocrit centrifugation technique (HCT)& Buffy coat
Western Africa	Nigeria	Kalu	2001	Sheep	304	49	T. congolense	haematocrit centrifugation technique (HCT)& Buffy coat
Western Africa	Nigeria	Kalu	2001	Sheep	304	33	T. brucei	haematocrit centrifugation technique (HCT)& Buffy coat
Western Africa	Nigeria	Kalu	2001	Goats	239	36	T. vivax	haematocrit centrifugation technique (HCT)& Buffy coat
Western Africa	Nigeria	Kalu	2001	Goats	239	17	T. congolense	haematocrit centrifugation technique (HCT)& Buffy coat
Western Africa	Nigeria	Kalu	2001	Goats	239	0	T. brucei	haematocrit centrifugation technique (HCT)& Buffy coat
Western Africa	Nigeria	Karshima	2016	Pigs	712	33	T. congolense	Species-specific PCR
Western Africa	Nigeria	Karshima	2016	Pigs	712	63	T. brucei	Species-specific PCR
Western Africa	Nigeria	Karshima	2016	Pigs	712	22	T. congolense & T. brucei	Species-specific PCR
Western Africa	Togo	Tchamdja	2017	Cattle	1,883	104	T. congolense	haematocrit centrifugation technique (HCT) & PCR-RFLP
Western Africa	Togo	Tchamdja	2017	Cattle	1,883	55	T. vivax	haematocrit centrifugation technique (HCT) & PCR-RFLP
Western Africa	Togo	Tchamdja	2017	Cattle	1,883	33	T. brucei	haematocrit centrifugation technique (HCT) & PCR-RFLP
Western Africa	Coˆte d'Ivoire	N'Djetchi	2017	Cattle	87	5	T. vivax	buffy coat-microscopy
Western Africa	Coˆte d'Ivoire	N'Djetchi	2017	Goats	136	2	T. vivax	buffy coat-microscopy
Western Africa	Coˆte d'Ivoire	N'Djetchi	2017	Sheep	192	9	T. vivax	buffy coat-microscopy
Western Africa	Coˆte d'Ivoire	N'Djetchi	2017	Pigs	137	41	T. brucei	buffy coat-microscopy
Western Africa	Coˆte d'Ivoire	N'Djetchi	2017	Cattle	87	15	T. brucei rhodesiense	PCR
Western Africa	Coˆte d'Ivoire	N'Djetchi	2017	Cattle	87	9	T. congolense	PCR
Western Africa	Coˆte d'Ivoire	N'Djetchi	2017	Cattle	87	9	T. vivax	PCR

Table 3. Continued

Region	Country	author	year	Animal_species	denom	overall_num	Trypanosoma_species	diagnostic_tool
Western Africa	Coˆte d'Ivoire	N'Djetchi	2017	Cattle	87	22	T. congolense & T. vivax + T. brucei rhodesiense	PCR
Western Africa	Coˆte d'Ivoire	N'Djetchi	2017	Goats	136	3	T. brucei rhodesiense	PCR
Western Africa	Coˆte d'Ivoire	N'Djetchi	2017	Goats	136	5	T. congolense	PCR
Western Africa	Coˆte d'Ivoire	N'Djetchi	2017	Goats	136	1	T. vivax	PCR
Western Africa	Coˆte d'Ivoire	N'Djetchi	2017	Goats	136	9	T. congolense & T. vivax + T. brucei rhodesiense	PCR
Western Africa	Coˆte d'Ivoire	N'Djetchi	2017	Sheep	192	8	T. brucei rhodesiense	PCR
Western Africa	Coˆte d'Ivoire	N'Djetchi	2017	Sheep	192	9	T. congolense	PCR
Western Africa	Coˆte d'Ivoire	N'Djetchi	2017	Sheep	192	9	T. vivax	PCR
Western Africa	Coˆte d'Ivoire	N'Djetchi	2017	Sheep	192	21	T. congolense & T. vivax + T. brucei rhodesiense	PCR
Western Africa	Coˆte d'Ivoire	N'Djetchi	2017	Pigs	137	50	T. brucei rhodesiense	PCR
Western Africa	Coˆte d'Ivoire	N'Djetchi	2017	Pigs	137	24	T. congolense	PCR
Western Africa	Coˆte d'Ivoire	N'Djetchi	2017	Pigs	137	0	T. vivax	PCR
Western Africa	Coˆte d'Ivoire	N'Djetchi	2017	Pigs	137	57	T. congolense & T. vivax + T. brucei rhodesiense	PCR
Western Africa	Coˆte d'Ivoire	Kouadio	2014	Cattle	363	103	T. congolense	PCR
Western Africa	Coˆte d'Ivoire	Kouadio	2014	Cattle	363	179	T. vivax	Species-specific PCR
Western Africa	Coˆte d'Ivoire	Kouadio	2014	Cattle	363	85	T. brucei sI	buffy coat-microscopy
Western Africa	Coˆte d'Ivoire	Kouadio	2014	Cattle	363	26	T. congolense & T. vivax + T. brucei	buffy coat-microscopy
Western Africa	Coˆte d'Ivoire	Kouadio	2014	Cattle	363	32	T. vivax	buffy coat-microscopy
Western Africa	Senegal	Seck	2010	Cattle	1,332	31	T. vivax	buffy coat-microscopy
Western Africa	Senegal	Seck	2010	Cattle	1,332	382	T. vivax	haematocrit centrifugation technique (HCT)
Western Africa	Senegal	Seck	2010	Cattle	1,332	58	T. congolense	ELISA
Western Africa	Senegal	Seck	2010	Cattle	1,332	3	T. brucei	ELISA
Central Africa	Cameroon	Abah	2020	Cattle	42	1	T. theileri	nested PCR
Central Africa	Cameroon	Abah	2020	Cattle	42	1	T. vivax	nested PCR
Central Africa	Cameroon	Suh	2017	Cattle	770	6	T. vivax	buffy coat-microscopy
Central Africa	Cameroon	Mamoudou	2006	Cattle	60	2	T. congolense	ELISA
Central Africa	Cameroon	Mamoudou	2010	Cattle	334	46	T. congolense	buffy coat-microscopy
Central Africa	Cameroon	Mamoudou	2010	Cattle	334	26	T. brucei	buffy coat-microscopy
Central Africa	Cameroon	Mamoudou	2010	Cattle	334	5	T. vivax	buffy coat-microscopy
Central Africa	Cameroon	Mamoudou	2010	Cattle	334	2	T. congolense & T. brucei	buffy coat-microscopy
Central Africa	Cameroon	Simo	2013	Pigs	225	59	T. congolense	buffy coat-microscopy
Central Africa	Cameroon	Simo	2013	Pigs	225	118	T. congolense	Species-specific PCR
Central Africa	Cameroon	Simo	2013	Goats	87	17	T. congolense	buffy coat-microscopy
Central Africa	Cameroon	Simo	2013	Goats	87	58	T. congolense	Species-specific PCR
Central Africa	Cameroon	Simo	2013	Sheep	65	7	T. congolense	buffy coat-microscopy
Central Africa	Cameroon	Simo	2013	Sheep	65	23	T. congolense	Species-specific PCR
Central Africa	Cameroon	Simo	2013	Dogs	20	3	T. congolense	buffy coat-microscopy
Central Africa	Cameroon	Simo	2013	Dogs	20	3	T. congolense	Species-specific PCR
Central Africa	Cameroon	Simo	2006	Pigs	133	46	T. vivax	PCR
Central Africa	Cameroon	Simo	2006	Pigs	133	53	T. brucei sI	PCR
Central Africa	Cameroon	Simo	2006	Pigs	133	61	T. congolense	PCR

Table 3. Continued

Region	Country	author	year	Animal_species	denom	overall_num	Trypanosoma_species	diagnostic_tool
Central Africa	Cameroon	Simo	2006	Pigs	133	15	T. brucei gambiense	PCR
Central Africa	Cameroon	Nkinin	2002	Pigs	32	21	T. brucei gambiense	CATT
Central Africa	Cameroon	Mbahin	2008	Cattle	302	19	T. congolense	buffy coat-microscopy
Central Africa	Cameroon	Mbahin	2008	Cattle	302	6	T. vivax	buffy coat-microscopy
Central Africa	Cameroon	Mbahin	2008	Cattle	302	4	T. brucei	buffy coat-microscopy
Central Africa	Cameroon	Mbahin	2008	Cattle	302	6	T. vivax & T. congolense	buffy coat-microscopy
Central Africa	Cameroon	Njiokou	2010a	Pigs	225	147	T. brucei sI	CATT
Central Africa	Cameroon	Njiokou	2010a	Goats	87	58	T. brucei sI	CATT
Central Africa	Cameroon	Njiokou	2010a	Sheep	65	43	T. brucei sI	CATT
Central Africa	Cameroon	Njiokou	2010a	Dogs	20	6	T. brucei sI	CATT
Central Africa	Cameroon	Njiokou	2010a	Pigs	225	59	T. brucei sI	microscopy
Central Africa	Cameroon	Njiokou	2010a	Goats	87	17	T. brucei sI	microscopy
Central Africa	Cameroon	Njiokou	2010a	Sheep	65	7	T. brucei sI	microscopy
Central Africa	Cameroon	Njiokou	2010a	Dogs	20	3	T. brucei sI	microscopy
Central Africa	Cameroon	Nimpaye	2011	Sheep	267	8	T. brucei sI	PCR
Central Africa	Cameroon	Nimpaye	2011	Sheep	267	1	T. brucei sI	PCR
Central Africa	Cameroon	Nimpaye	2011	Sheep	267	23	T. vivax	PCR
Central Africa	Cameroon	Nimpaye	2011	goats	264	26	T. congolense	PCR
Central Africa	Cameroon	Nimpaye	2011	Goats	264	2	T. simiae	PCR
Central Africa	Cameroon	Nimpaye	2011	Goats	264	48	T. vivax	PCR
Central Africa	Cameroon	Nimpaye	2011	Pigs	307	110	T. vivax	PCR
Central Africa	Cameroon	Nimpaye	2011	Pigs	307	62	T. congolense	PCR
Central Africa	Cameroon	Nimpaye	2011	Dogs	37	1	T. vivax	PCR
Central Africa	Cameroon	Nimpaye	2011	dogs	37	3	T. congolense	PCR
Central Africa	Equitorial Guinea	Cordon-obras	2009	Sheep	218	8	T. congolense	Species-specific PCR
Central Africa	Equitorial Guinea	Cordon-obras	2009	Sheep	218	6	T. vivax	Species-specific PCR
Central Africa	Equitorial Guinea	Cordon-obras	2009	Sheep	218	90	T. brucei sI	Species-specific PCR
Central Africa	Equitorial Guinea	Cordon-obras	2009	Sheep	218	4	T. brucei gambiense	Species-specific PCR
Central Africa	Equitorial Guinea	Cordon-obras	2009	Goats	456	29	T. congolense	Species-specific PCR
Central Africa	Equitorial Guinea	Cordon-obras	2009	Goats	456	4	T. vivax	Species-specific PCR
Central Africa	Equitorial Guinea	Cordon-obras	2009	Goats	456	212	T. brucei sI	Species-specific PCR
Central Africa	Equitorial Guinea	Cordon-obras	2009	Goats	456	3	T. brucei gambiense	Species-specific PCR
Central Africa	Equitorial Guinea	Cordon-obras	2009	Pigs	24	7	T. brucei sI	Species-specific PCR
Central Africa	Equitorial Guinea	Cordon-obras	2009	Pigs	24	0	T. congolense	Species-specific PCR
Central Africa	Equitorial Guinea	Cordon-obras	2009	pigs	24	0	T. vivax	Species-specific PCR

Table 3. Continued

Region	Country	author	year	Animal_species	denom	overall_num	Trypanosoma_species	diagnostic_tool
Central Africa	Equitorial Guinea	Cordon-obras	2009	Pigs	24	0	T. brucei	Species-specific PCR
Central Africa	Equitorial Guinea	Cordon-obras	2010	Pigs	63	8	T. brucei sI	Species-specific PCR
Central Africa	Equitorial Guinea	Cordon-obras	2010	Goats	24	1	T. brucei sI	Species-specific PCR
Central Africa	Gabon	Maganga	2017	Cattle	224	56	T. congolense	ITS1 PCR
Central Africa	Gabon	Maganga	2017	Cattle	224	16	T. vivax	ITS1 PCR
Central Africa	Gabon	Maganga	2017	Cattle	224	5	T. vivax & T. congolense	ITS1 PCR
Central Africa	Gabon	Cossic	2017	Cattle	480	28	T. congolense	buffy coat-microscopy
Central Africa	Gabon	Cossic	2017	Cattle	480	1	T. vivax	buffy coat-microscopy
Eastern Africa	Ethiopia	Yohannes	2014	Cattle	500	21	T. congolense	buffy coat-microscopy
Eastern Africa	Ethiopia	Yigzaw	2017	Cattle	383	5	T. congolense	buffy coat-microscopy
Eastern Africa	Ethiopia	Yigzaw	2017	Cattle	383	2	T. congolense & T. brucei	buffy coat-microscopy
Eastern Africa	Ethiopia	Yigzaw	2017	Cattle	383	1	T. brucei	buffy coat-microscopy
Eastern Africa	Ethiopia	Tikuye & Yalew	2017	Cattle	400	44	T. congolense	buffy coat-microscopy
Eastern Africa	Ethiopia	Tikuye & Yalew	2017	Cattle	400	24	T. vivax	buffy coat-microscopy
Eastern Africa	Ethiopia	Tikuye & Yalew	2017	Cattle	400	10	T. brucei	buffy coat-microscopy
Eastern Africa	Ethiopia	Tikuye & Yalew	2017	Cattle	400	7	T. vivax & T. congolense	buffy coat-microscopy
Eastern Africa	Ethiopia	Wondimu	2017	cattle	400	29	T. congolense	buffy coat-microscopy
Eastern Africa	Ethiopia	Wondimu	2017	Cattle	400	14	T. vivax	buffy coat-microscopy
Eastern Africa	Ethiopia	Wondimu	2017	Cattle	400	3	T. brucei	buffy coat-microscopy
Eastern Africa	Ethiopia	Wondimu	2017	Cattle	400	2	T. vivax & T. congolense	buffy coat-microscopy
Eastern Africa	Ethiopia	Tola	2016	Cattle	248	53	T. congolense	buffy coat-microscopy
Eastern Africa	Ethiopia	Tola	2016	Cattle	248	3	T. vivax	buffy coat-microscopy
Eastern Africa	Ethiopia	Tola	2016	Cattle	248	1	T. vivax & T. congolense	buffy coat-microscopy
Eastern Africa	Ethiopia	Tewelde	2004	Cattle	904	54	T. congolense	buffy coat-microscopy
Eastern Africa	Ethiopia	Tewelde	2005	Cattle	904	12	T. vivax	buffy coat-microscopy
Eastern Africa	Ethiopia	Tewelde	2006	Cattle	904	3	T. brucei	buffy coat-microscopy
Eastern Africa	Ethiopia	Tewelde	2007	Cattle	904	1	T. vivax & T. congolense	buffy coat-microscopy
Eastern Africa	Ethiopia	Teka	2012	Cattle	384	13	T. congolense	buffy coat-microscopy
Eastern Africa	Ethiopia	Teka	2012	Cattle	384	2	T. vivax & T. congolense	buffy coat-microscopy
Eastern Africa	Ethiopia	Teka	2012	Cattle	384	1	T. vivax	buffy coat-microscopy
Eastern Africa	Ethiopia	Tafese	2012	Cattle	386	24	T. congolense	buffy coat-microscopy
Eastern Africa	Ethiopia	Tafese	2012	Cattle	386	9	T. vivax	buffy coat-microscopy
Eastern Africa	Ethiopia	Tadesse	2010	Cattle	250	2	T. vivax	buffy coat-microscopy
Eastern Africa	Ethiopia	Tadesse	2010	Cattle	250	4	T. congolense	buffy coat-microscopy
Eastern Africa	Ethiopia	Tadesse	2010	Cattle	250	2	T. brucei	buffy coat-microscopy
Eastern Africa	Ethiopia	Tadesse	2010	Cattle	250	1	T. vivax & T. brucei	buffy coat-microscopy
Eastern Africa	Ethiopia	Tadesse	2010	Cattle	250	1	T. congolense & T. brucei	buffy coat-microscopy
Eastern Africa	Ethiopia	Tadesse	2010	Cattle	250	2	T. vivax & T. congolense	buffy coat-microscopy
Eastern Africa	Ethiopia	Mulatu	2016	Cattle	543	44	T. congolense	buffy coat-microscopy
Eastern Africa	Ethiopia	Mulatu	2016	Cattle	543	23	T. vivax	buffy coat-microscopy
Eastern Africa	Ethiopia	Muktar	2016	Cattle	217	42	T. congolense	buffy coat-microscopy
Eastern Africa	Ethiopia	Muktar	2016	Cattle	217	21	T. vivax	buffy coat-microscopy

Table 3. Continued

Region	Country	author	year	Animal_species	denom	overall_num	Trypanosoma_species	diagnostic_tool
Eastern Africa	Ethiopia	Moti	2015	Cattle	587	106	T. congolense	haematocrit centrifugation technique (HCT)
Eastern Africa	Ethiopia	Moti	2015	Cattle	587	41	T. congolense	PCR-RFLP
Eastern Africa	Ethiopia	Moti	2015	Cattle	587	18	T. vivax	PCR-RFLP
Eastern Africa	Ethiopia	Moti	2015	Cattle	587	5	T. theileri	PCR-RFLP
Eastern Africa	Ethiopia	Miruk	2008	Cattle	341	29	T. congolense	buffy coat-microscopy
Eastern Africa	Ethiopia	Miruk	2008	Cattle	341	3	T. vivax	buffy coat-microscopy
Eastern Africa	Ethiopia	Miruk	2008	Cattle	341	3	T. brucei	buffy coat-microscopy
Eastern Africa	Ethiopia	Miruk	2008	Cattle	341	5	T. vivax & T. congolense	buffy coat-microscopy
Eastern Africa	Ethiopia	Mihret & Mamo	2007	Cattle	3,360	249	T. vivax	buffy coat-microscopy
Eastern Africa	Ethiopia	Mihret & Mamo	2007	Cattle	3,360	11	T. congolense	buffy coat-microscopy
Eastern Africa	Ethiopia	Mihret & Mamo	2007	Cattle	3,360	15	T. vivax & T. congolense	buffy coat-microscopy
Eastern Africa	Ethiopia	melese	2017	Cattle	400	15	T. congolense	buffy coat-microscopy
Eastern Africa	Ethiopia	melese	2017	Cattle	400	6	T. vivax	buffy coat-microscopy
Eastern Africa	Ethiopia	Lelisa	2016	Cattle	566	15	T. congolense	buffy coat-microscopy
Eastern Africa	Ethiopia	Lelisa	2016	Cattle	566	7	T. vivax	buffy coat-microscopy
Eastern Africa	Ethiopia	Lelisa	2016	Cattle	566	2	T. brucei	buffy coat-microscopy
Eastern Africa	Ethiopia	Kidanemariam	2002	Cattle	1,008	108	T. vivax	buffy coat-microscopy
Eastern Africa	Ethiopia	Kidanemariam	2002	Cattle	1,008	43	T. congolense	buffy coat-microscopy
Eastern Africa	Ethiopia	Kidanemariam	2002	Cattle	1008	1	T. vivax & T. congolense	buffy coat-microscopy
Eastern Africa	Ethiopia	Kedir	2016	Cattle	862	94	T. vivax	buffy coat-microscopy
Eastern Africa	Ethiopia	Kedir	2016	Cattle	862	36	T. congolense	buffy coat-microscopy
Eastern Africa	Ethiopia	Kedir	2016	Cattle	862	10	T. brucei	buffy coat-microscopy
Eastern Africa	Ethiopia	Kassaye	2015	Cattle	599	80	T. congolense	buffy coat-microscopy
Eastern Africa	Ethiopia	Kassaye	2015	Cattle	599	11	T. vivax	buffy coat-microscopy
Eastern Africa	Ethiopia	Kassaye	2015	cattle	599	10	T. vivax & T. congolense	buffy coat-microscopy
Eastern Africa	Ethiopia	Haile	2016	Cattle	488	16	T. congolense	buffy coat-microscopy
Eastern Africa	Ethiopia	Haile	2016	Cattle	488	2	T. vivax	buffy coat-microscopy
Eastern Africa	Ethiopia	Haile	2016	Cattle	488	1	T. brucei	buffy coat-microscopy
Eastern Africa	Ethiopia	Zemedkun	2016	Cattle	480	8	T. vivax	buffy coat-microscopy
Eastern Africa	Ethiopia	Zemedkun	2016	Cattle	480	32	T. congolense	buffy coat-microscopy
Eastern Africa	Ethiopia	Girmay	2016	Cattle	300	11	T. vivax & T. congolense	buffy coat-microscopy
Eastern Africa	Ethiopia	Fentahun & Tekeba	2012	Cattle	388	22	T. vivax	buffy coat-microscopy
Eastern Africa	Ethiopia	Fentahun & Tekeba	2012	Cattle	388	16	T. congolense	buffy coat-microscopy
Eastern Africa	Ethiopia	Eshetu	2017	Cattle	384	20	T. congolense	buffy coat-microscopy
Eastern Africa	Ethiopia	Eshetu	2017	Cattle	384	12	T. vivax	buffy coat-microscopy
Eastern Africa	Ethiopia	Dagnachew	2011	Cattle	300	22	T. congolense	buffy coat-microscopy
Eastern Africa	Ethiopia	Dagnachew	2011	Cattle	300	12	T. vivax	buffy coat-microscopy
Eastern Africa	Ethiopia	Bishaw	2012	Cattle	384	24	T. vivax	buffy coat-microscopy
Eastern Africa	Ethiopia	Bishaw	2012	Cattle	384	6	T. congolense	buffy coat-microscopy
Eastern Africa	Ethiopia	Zone	2017	Cattle	384	27	T. congolense	buffy coat-microscopy
Eastern Africa	Ethiopia	Zone	2017	Cattle	384	19	T. vivax	buffy coat-microscopy
Eastern Africa	Ethiopia	Zone	2017	Cattle	384	37	T. brucei	buffy coat-microscopy
Eastern Africa	Ethiopia	Zone	2017	Cattle	384	39	T. vivax & T. congolense	buffy coat-microscopy
Eastern Africa	Ethiopia	Bekele	2018	Cattle	364	13	T. congolense	buffy coat-microscopy
Eastern Africa	Ethiopia	Bekele	2018	Cattle	364	2	T. vivax	buffy coat-microscopy

Table 3. Continued

Region	Country	author	year	Animal_species	denom	overall_num	Trypanosoma_species	diagnostic_tool
Eastern Africa	Ethiopia	Bekele	2018	Cattle	364	1	T. brucei	buffy coat-microscopy
Eastern Africa	Ethiopia	Bekele	2010	Cattle	323	49	T. congolense	haematocrit centrifugation technique (HCT)
Eastern Africa	Ethiopia	Bekele	2010	Cattle	323	14	T. vivax	haematocrit centrifugation technique (HCT)
Eastern Africa	Ethiopia	Bekele	2010	Cattle	323	6	T. brucei	haematocrit centrifugation technique (HCT)
Eastern Africa	Ethiopia	Ayele	2016	Cattle	248	53	T. congolense	buffy coat-microscopy
Eastern Africa	Ethiopia	Ayele	2016	Cattle	248	3	T. vivax	buffy coat-microscopy
Eastern Africa	Ethiopia	Ayele	2016	Cattle	248	1	T. vivax & T. congolense	buffy coat-microscopy
Eastern Africa	Ethiopia	Abera	2014	Cattle	384	14	T. congolense	buffy coat-microscopy
Eastern Africa	Ethiopia	Abera	2014	Cattle	384	9	T. vivax	buffy coat-microscopy
Eastern Africa	Ethiopia	Abera	2014	Cattle	384	1	T. brucei	buffy coat-microscopy
Eastern Africa	Ethiopia	Abera	2016	Cattle	300	42	T. congolense	buffy coat-microscopy
Eastern Africa	Ethiopia	Abera	2016	Cattle	300	15	T. vivax	buffy coat-microscopy
Eastern Africa	Ethiopia	Abera	2016	Cattle	300	8	T. brucei	buffy coat-microscopy
Eastern Africa	Ethiopia	Abebe	2017	Cattle	1,508	89	T. congolense	buffy coat-microscopy
Eastern Africa	Ethiopia	Abebe	2017	Cattle	1,508	24	T. vivax	buffy coat-microscopy
Eastern Africa	Ethiopia	Abebe	2017	Cattle	1,508	2	T. brucei	buffy coat-microscopy
Eastern Africa	Ethiopia	Abebe	2017	Cattle	1,508	3	T. vivax & T. congolense	buffy coat-microscopy
Eastern Africa	Ethiopia	Sebele	2015	Cattle	177	15	T. vivax	buffy coat-microscopy
Eastern Africa	Ethiopia	Sebele	2015	Sheep	180	2	T. vivax	buffy coat-microscopy
Eastern Africa	Ethiopia	Sebele	2015	Goats	27	7	T. vivax	buffy coat-microscopy
Eastern Africa	Ethiopia	Fentahun & Tekeba	2013	Cattle	388	22	T. vivax	buffy coat-microscopy
Eastern Africa	Ethiopia	Fentahun & Tekeba	2013	Cattle	388	16	T. congolense	buffy coat-microscopy
Eastern Africa	Ethiopia	Zeryehun	2012	Cattle	461	77	T. congolense	buffy coat-microscopy
Eastern Africa	Ethiopia	Zeryehun	2012	Cattle	461	18	T. vivax	buffy coat-microscopy
Eastern Africa	Ethiopia	Zeryehun	2012	Cattle	461	31	T. vivax & T. congolense	buffy coat-microscopy
Eastern Africa	Ethiopia	Nuraddis & Jimma	2015	Cattle	310	47	T. congolense	buffy coat-microscopy
Eastern Africa	Ethiopia	Nuraddis & Jimma	2015	donkey	310	16	T. vivax	buffy coat-microscopy
Eastern Africa	Ethiopia	Nuraddis & Jimma	2015	donkey	310	8	T. brucei	buffy coat-microscopy
Eastern Africa	Ethiopia	Nuraddis & Jimma	2015	donkey	310	9	T. vivax & T. congolense	buffy coat-microscopy
Eastern Africa	Ethiopia	Nuraddis & Jimma	2015	Cattle	384	204	T. congolense	microscopy
Eastern Africa	Ethiopia	Takile	2014	Cattle	384	115	T. vivax	microscopy
Eastern Africa	Ethiopia	Takile	2014	Cattle	384	65	T. brucei	microscopy
Eastern Africa	Ethiopia	sheferaw	2016	Cattle	1,838	1231	T. congolense	buffy coat-microscopy
Eastern Africa	Ethiopia	sheferaw	2016	Cattle	1,838	607	T. vivax	buffy coat-microscopy
Eastern Africa	Ethiopia	Mulaw	2011	Cattle	384	72	T. congolense	buffy coat-microscopy
Eastern Africa	Ethiopia	Mulaw	2011	Cattle	384	21	T. vivax & T. congolense	buffy coat-microscopy
Eastern Africa	Ethiopia	Mulaw	2011	Cattle	384	10	T. vivax & T. brucei	buffy coat-microscopy
Eastern Africa	Ethiopia	Moti	2014	Cattle	411	16	T. congolense	haematocrit centrifugation technique (HCT)
Eastern Africa	Ethiopia	Moti	2014	Cattle	411	23	T. vivax	haematocrit centrifugation technique (HCT)
Eastern Africa	Ethiopia	Moti	2014	Cattle	411	8	T. vivax & T. congolense	haematocrit centrifugation technique (HCT)
Eastern Africa	Ethiopia	Moti	2014	Cattle	411	2	T. vivax & T. brucei	haematocrit centrifugation technique (HCT)
Eastern Africa	Ethiopia	Moti	2014	Cattle	411	73	T. congolense	PCR-RFLP
Eastern Africa	Ethiopia	Moti	2014	Cattle	411	2	T. vivax	PCR-RFLP
Eastern Africa	Ethiopia	Moti	2014	Cattle	411	0	T. vivax & T. congolense	PCR-RFLP
Eastern Africa	Ethiopia	Moti	2014	Cattle	411	0	T. vivax & T. brucei	PCR-RFLP

Table 3. Continued

Region	Country	author	year	Animal_species	denom	overall_num	Trypanosoma_species	diagnostic_tool
Eastern Africa	Ethiopia	Mekuria & Gadissa	2011	Cattle	540	52	T. congolense	buffy coat-microscopy
Eastern Africa	Ethiopia	Mekuria & Gadissa	2011	Cattle	540	10	T. vivax	buffy coat-microscopy
Eastern Africa	Ethiopia	Mekuria & Gadissa	2011	Cattle	540	4	T. brucei	buffy coat-microscopy
Eastern Africa	Ethiopia	Mekuria & Gadissa	2011	Cattle	540	1	T. vivax & T. congolense	buffy coat-microscopy
Eastern Africa	Ethiopia	Kitila	2017	Cattle	408	20	T. congolense	buffy coat-microscopy
Eastern Africa	Ethiopia	Kitila	2017	Cattle	408	8	T. vivax	buffy coat-microscopy
Eastern Africa	Ethiopia	Kitila	2017	Cattle	408	2	T. vivax & T. congolense	buffy coat-microscopy
Eastern Africa	Ethiopia	Kenaw	2015	Cattle	202	40	T. congolense	buffy coat-microscopy
Eastern Africa	Ethiopia	Kenaw	2015	Cattle	202	6	T. vivax	buffy coat-microscopy
Eastern Africa	Ethiopia	Kenaw	2015	Cattle	202	1	T. vivax & T. congolense	buffy coat-microscopy
Eastern Africa	Ethiopia	Kassa & Megerssa,	2017	Cattle	384	55	T. congolense	buffy coat-microscopy
Eastern Africa	Ethiopia	Kassa & Megerssa,	2017	Cattle	384	22	T. vivax	buffy coat-microscopy
Eastern Africa	Ethiopia	Kassa & Megerssa,	2017	Cattle	384	21	T. brucei	buffy coat-microscopy
Eastern Africa	Ethiopia	Kacho & Singh	2017	Cattle	780	11	T. vivax	buffy coat-microscopy
Eastern Africa	Ethiopia	Kacho & Singh	2017	Cattle	780	88	T. congolense	buffy coat-microscopy
Eastern Africa	Ethiopia	Kacho & Singh	2017	Cattle	780	2	T. brucei	buffy coat-microscopy
Eastern Africa	Ethiopia	Kacho & Singh	2017	Cattle	780	9	T. vivax & T. congolense	buffy coat-microscopy
Eastern Africa	Ethiopia	Kacho & Singh	2017	Cattle	780	1	T. theileri	buffy coat-microscopy
Eastern Africa	Ethiopia	Golessa & Mekonnen	2017	Cattle	395	18	T. vivax	buffy coat-microscopy
Eastern Africa	Ethiopia	Golessa & Mekonnen	2017	Cattle	395	26	T. congolense	buffy coat-microscopy
Eastern Africa	Ethiopia	Golessa & Mekonnen	2017	Cattle	395	1	T. brucei	buffy coat-microscopy
Eastern Africa	Ethiopia	Golessa & Mekonnen	2017	Cattle	395	2	T. vivax & T. congolense	buffy coat-microscopy
Eastern Africa	Ethiopia	Marta	2016	cattle	384	46	T.congolense	buffy coat-microscopy
Eastern Africa	Ethiopia	Marta	2016	cattle	384	3	T.vivax	buffy coat-microscopy
Eastern Africa	Ethiopia	Marta	2016	cattle	384	0	T.brucei	buffy coat-microscopy
Eastern Africa	Ethiopia	Marta	2016	cattle	384	3	T.vivax & T.congolense	buffy coat-microscopy
Eastern Africa	Ethiopia	Fikru	2012	Cattle	1,524	65	T. vivax	haematocrit centrifugation technique (HCT)
Eastern Africa	Ethiopia	Fikru	2012	Cattle	1,524	22	T. congolense	haematocrit centrifugation technique (HCT)
Eastern Africa	Ethiopia	Fikru	2012	Cattle	1,524	4	T. brucei	haematocrit centrifugation technique (HCT)
Eastern Africa	Ethiopia	Fikru	2012	Cattle	1,524	379	T. vivax	ITS1 PCR
Eastern Africa	Ethiopia	Fikru	2012	Cattle	1,524	44	T. congolense	ITS1 PCR
Eastern Africa	Ethiopia	Fikru	2012	Cattle	1,524	24	T. brucei	ITS1 PCR
Eastern Africa	Ethiopia	Fikru	2012	Cattle	1,524	91	T. theileri	ITS1 PCR
Eastern Africa	Ethiopia	Fikru	2012	Cattle	1,524	229	T. vivax & T. congolense	ITS1 PCR
Eastern Africa	Ethiopia	Fentahun	2012	Cattle	388	16	T. congolense	buffy coat-microscopy
Eastern Africa	Ethiopia	Fentahun	2012	Cattle	388	22	T. vivax	buffy coat-microscopy
Eastern Africa	Ethiopia	Fentahun	2012	cattle	388	10	T. brucei	buffy coat-microscopy
Eastern Africa	Ethiopia	Efrem	2010	Cattle	568	47	T. congolense	buffy coat-microscopy
Eastern Africa	Ethiopia	Efrem	2010	Cattle	568	24	T. vivax	buffy coat-microscopy
Eastern Africa	Ethiopia	Duguma	2015	Cattle	7,021	513	T. congolense	buffy coat-microscopy
Eastern Africa	Ethiopia	Duguma	2015	Cattle	7,021	122	T. vivax	buffy coat-microscopy
Eastern Africa	Ethiopia	Duguma	2015	Cattle	7,021	24	T. brucei	buffy coat-microscopy
Eastern Africa	Ethiopia	Degneh	2017	Cattle	930	562	T. congolense	buffy coat-microscopy
Eastern Africa	Ethiopia	Degneh	2017	Cattle	930	272	T. vivax	buffy coat-microscopy

Table 3. Continued

Region	Country	author	year	Animal_species	denom	overall_num	Trypanosoma_species	diagnostic_tool
Eastern Africa	Ethiopia	Dagnachew	2017	Cattle	1,435	62	T. vivax	buffy coat-microscopy
Eastern Africa	Ethiopia	Dagnachew	2017	Cattle	1,435	230	T. congolense	buffy coat-microscopy
Eastern Africa	Ethiopia	Dagnachew	2017	Cattle	1,435	14	T. vivax & T. congolense	buffy coat-microscopy
Eastern Africa	Ethiopia	Dagnachew & Shibeshi	2011	Cattle	368	21	T. vivax	buffy coat-microscopy
Eastern Africa	Ethiopia	Dagnachew & Shibeshi	2011	Cattle	368	12	T. congolense	buffy coat-microscopy
Eastern Africa	Ethiopia	Cherenet	2006	Cattle	240	45	T. vivax	ELISA
Eastern Africa	Ethiopia	Cherenet	2006	Cattle	240	36	T. congolense	ELISA
Eastern Africa	Ethiopia	Cherenet	2006	Cattle	240	9	T. brucei	ELISA
Eastern Africa	Ethiopia	Cherenet	2006	Cattle	240	14	T. vivax & T. congolense	ELISA
Eastern Africa	Ethiopia	Biyazen	2014	Cattle	384	6	T. congolense	buffy coat-microscopy
Eastern Africa	Ethiopia	Biyazen	2014	Cattle	384	2	T. vivax	buffy coat-microscopy
Eastern Africa	Ethiopia	Biyazen	2014	Cattle	384	0	T. brucei	buffy coat-microscopy
Eastern Africa	Ethiopia	Bitew	2011	Cattle	300	16	T. vivax	buffy coat-microscopy
Eastern Africa	Ethiopia	Bitew	2011	Cattle	300	19	T. congolense	buffy coat-microscopy
Eastern Africa	Ethiopia	Bekele & Nasir	2011	Cattle	384	24	T. congolense	buffy coat-microscopy
Eastern Africa	Ethiopia	Bekele & Nasir	2011	Cattle	384	7	T. vivax	buffy coat-microscopy
Eastern Africa	Ethiopia	Bekele & Nasir	2011	Cattle	384	2	T. brucei	buffy coat-microscopy
Eastern Africa	Ethiopia	Ayana	2012	Cattle	384	8	T. vivax	buffy coat-microscopy
Eastern Africa	Ethiopia	Ali & Bitew	2011	Cattle	385	60	T. congolense	buffy coat-microscopy
Eastern Africa	Ethiopia	Ali & Bitew	2011	Cattle	385	13	T. vivax	buffy coat-microscopy
Eastern Africa	Ethiopia	Ali & Bitew	2011	Cattle	385	11	T. brucei	buffy coat-microscopy
Eastern Africa	Ethiopia	Ali & Bitew	2011	Cattle	385	11	T. vivax & T. congolense	buffy coat-microscopy
Eastern Africa	Ethiopia	Aki	2016	Cattle	519	7	T. vivax	buffy coat-microscopy
Eastern Africa	Ethiopia	Aki	2016	Cattle	519	22	T. congolense	buffy coat-microscopy
Eastern Africa	Ethiopia	Aki & Dinede	2016	Cattle	391	2	T. congolense	buffy coat-microscopy
Eastern Africa	Ethiopia	Aki & Dinede	2016	Cattle	391	48	T. vivax	buffy coat-microscopy
Eastern Africa	Ethiopia	Aki & Dinede	2016	cattle	391	2	T. vivax & T. congolense	buffy coat-microscopy
Eastern Africa	Ethiopia	Mekuria & Tesfaye	2017	Sheep	175	33	T. theileri	microscopy
Eastern Africa	Ethiopia	Mekuria & Tesfaye	2017	Goats	25	5	T. theileri	microscopy
Eastern Africa	Ethiopia	Sinshaw	2006	Cattle	1,509	92	T. vivax	buffy coat-microscopy
Eastern Africa	Ethiopia	Sinshaw	2006	Sheep	122	1	T. vivax	buffy coat-microscopy
Eastern Africa	Ethiopia	Sinshaw	2006	Goats	676	0	T. vivax	buffy coat-microscopy
Eastern Africa	Ethiopia	Sitotaw	2014	Cattle	177	6	T. vivax	haematocrit centrifugation technique (HCT)
Eastern Africa	Ethiopia	Sitotaw	2014	Sheep	180	0	T. vivax	haematocrit centrifugation technique (HCT)
Eastern Africa	Ethiopia	Sitotaw	2014	Goats	27	0	T. vivax	haematocrit centrifugation technique (HCT)
Eastern Africa	Ethiopia	Fikru	2015	Camel	399	8	T. evansi	microscopy
Eastern Africa	Ethiopia	Fikru	2015	Camel	399	96	T. evansi	CATT
Eastern Africa	Ethiopia	Fikru	2015	Camel	399	51	T. evansi	PCR
Eastern Africa	Ethiopia	Hagos	2009	Camel	619	75	T. evansi	buffy coat-microscopy
Eastern Africa	Ethiopia	Hagos	2009	Camel	619	154	T. evansi	CATT
Eastern Africa	Ethiopia	Zeleke	2001	Camel	200	42	T. evansi	buffy coat-microscopy
Eastern Africa	Ethiopia	Giro	2020	Camel	385	41	T. evansi	buffy coat-microscopy

Table 3. Continued

Region	Country	author	year	Animal_species	denom	overall_num	Trypanosoma_species	diagnostic_tool
Eastern Africa	Ethiopia	Weldegebrial	2015	Camel	408	21	T. evansi	haematocrit centrifugation technique (HCT)
Eastern Africa	Ethiopia	Weldegebrial	2015	Camel	408	98	T. evansi	CATT
Eastern Africa	Ethiopia	Kassa	2011	Camel	383	18	T. evansi	haematocrit centrifugation technique (HCT)
Eastern Africa	Ethiopia	Kassa	2011	Camel	383	17	T. evansi	microscopy
Eastern Africa	Ethiopia	Lelisa	2016	Cattle	566	363	T. congolense	buffy coat-microscopy
Eastern Africa	Ethiopia	Lelisa	2016	Cattle	566	159	T. vivax	buffy coat-microscopy
Eastern Africa	Ethiopia	Lelisa	2016	Cattle	566	45	T. brucei	buffy coat-microscopy
Eastern Africa	Ethiopia	Dinka	2005	Sheep	196	7	T. congolense	buffy coat-microscopy
Eastern Africa	Ethiopia	Dinka	2005	Sheep	196	4	T. vivax	buffy coat-microscopy
Eastern Africa	Ethiopia	Dinka	2005	Sheep	196	1	T. brucei	buffy coat-microscopy
Eastern Africa	Ethiopia	Dinka	2005	Sheep	196	2	T. vivax & T.congolense	buffy coat-microscopy
Eastern Africa	Ethiopia	Dinka	2005	Sheep	196	2	T. vivax & T.brucei	buffy coat-microscopy
Eastern Africa	Ethiopia	Dinka	2005	Goats	337	4	T. congolense	buffy coat-microscopy
Eastern Africa	Ethiopia	Dinka	2005	Goats	337	3	T. vivax	buffy coat-microscopy
Eastern Africa	Ethiopia	Dinka	2005	Goats	337	1	T. brucei	buffy coat-microscopy
Eastern Africa	Ethiopia	Dinka	2005	Goats	337	3	T. vivax & T. congolense	buffy coat-microscopy
Eastern Africa	Ethiopia	Dinka	2005	Goats	337	1	T. vivax & T. brucei	buffy coat-microscopy
Eastern Africa	Ethiopia	Tadesse	2011	Sheep	145	1	T. congolense	microscopy
Eastern Africa	Ethiopia	Tadesse	2011	Sheep	145	1	T. vivax	microscopy
Eastern Africa	Ethiopia	Tadesse	2011	Goats	234	3	T. congolense	microscopy
Eastern Africa	Ethiopia	Tadesse	2011	Goats	234	3	T. vivax	microscopy
Eastern Africa	Ethiopia	Leta	2010	Goats	654	437	T. congolense	haematocrit centrifugation technique (HCT)& Buffy coat
Eastern Africa	Ethiopia	Leta	2010	Goats	654	137	T. vivax	haematocrit centrifugation technique (HCT)& Buffy coat
Eastern Africa	Ethiopia	Leta	2010	Goats	654	54	T. brucei	haematocrit centrifugation technique (HCT)& Buffy coat
Eastern Africa	Ethiopia	Leta	2010	Goats	654	28	T. vivax & T. congolense	haematocrit centrifugation technique (HCT)& Buffy coat
Eastern Africa	Ethiopia	Leta	2010	Sheep	66	22	T. congolense	haematocrit centrifugation technique (HCT)& Buffy coat
Eastern Africa	Ethiopia	Leta	2010	Sheep	66	0	T. vivax	haematocrit centrifugation technique (HCT)& Buffy coat
Eastern Africa	Ethiopia	Leta	2010	sheep	66	22	T. brucei	haematocrit centrifugation technique (HCT)& Buffy coat
Eastern Africa	Ethiopia	Leta	2010	Sheep	66	22	T. vivax & T. congolense	haematocrit centrifugation technique (HCT)& Buffy coat
Eastern Africa	Ethiopia	Birhanu	2015	cattle,horses, sheep, camel, goats,mules	493	18	T. vivax	ELISA
Eastern Africa	Ethiopia	Birhanu	2015	Cattle	493	12	T. vivax	haematocrit centrifugation technique (HCT)
Eastern Africa	Ethiopia	Birhanu	2015	Cattle	493	30	T. evansi	PCR
Eastern Africa	Ethiopia	Birhanu	2015	Cattle	493	183	T. evansi	PCR
Eastern Africa	Ethiopia	Birhanu	2015	horses	25	7	T. evansi	CATT
Eastern Africa	Ethiopia	Birhanu	2015	Camel	754	88	T. evansi	PCR
Eastern Africa	Ethiopia	Birhanu	2015	Camel	754	26	T. vivax	PCR
Eastern Africa	Ethiopia	Birhanu	2015	donkey	84	5	T. evansi	PCR
Eastern Africa	Ethiopia	Birhanu	2015	Sheep	181	3	T. evansi	PCR
Eastern Africa	Ethiopia	Birhanu	2015	Sheep	181	3	T. vivax	PCR
Eastern Africa	Ethiopia	Birhanu	2015	Goats	264	10	T. evansi	PCR
Eastern Africa	Ethiopia	Birhanu	2015	Goats	264	7	T. vivax	PCR
Eastern Africa	Ethiopia	Birhanu	2015	Mules	10	1	T. evansi	PCR
Eastern Africa	Ethiopia	Terefe	2015	Cattle	409	229	T. congolense	PCR

Table 3. Continued

Region	Country	author	year	Animal_species	denom	overall_num	Trypanosoma_species	diagnostic_tool
Eastern Africa	Ethiopia	Terefe	2015	Cattle	409	163	T. vivax	buffy coat-microscopy
Eastern Africa	Ethiopia	Terefe	2015	Cattle	409	16	T. brucei	buffy coat-microscopy
Eastern Africa	Ethiopia	kebede	2016	Cattle	589	507	T. congolense	microscopy
Eastern Africa	Ethiopia	kebede	2016	Cattle	589	82	T. vivax	microscopy
Eastern Africa	Kenya	Kivali	2020	Cattle	888	0	T. brucei	buffy coat-microscopy
Eastern Africa	Kenya	Kivali	2020	Cattle	888	7	T. brucei	microscopy
Eastern Africa	Kenya	Kivali	2020	Cattle	888	3	T. congolense	PCR
Eastern Africa	Kenya	Kivali	2020	Cattle	888	0	T. congolense	microscopy
Eastern Africa	Kenya	Kivali	2020	Cattle	888	12	T. vivax	PCR
Eastern Africa	Kenya	Kivali	2020	Cattle	888	11	T. vivax	microscopy
Eastern Africa	Kenya	Ng'ayo	2005	sheep, goats and pigs	402	22	T. vivax	PCR
Eastern Africa	Kenya	Ng'ayo	2005	sheep, goats and pigs	402	22	T. simiae	PCR
Eastern Africa	Kenya	Ng'ayo	2005	sheep, goats and pigs	402	10	T. congolense	PCR
Eastern Africa	Kenya	Ng'ayo	2005	sheep, goats and pigs	402	20	T. brucei	PCR
Eastern Africa	Kenya	Wissmann	2011	Cattle	2,773	363	T. vivax	PCR
Eastern Africa	Kenya	Wissmann	2011	Cattle	2,773	354	T. brucei sI	PCR
Eastern Africa	Kenya	Wissmann	2011	Cattle	2,773	507	T. brucei rhodesiense	PCR
Eastern Africa	Kenya	Wissmann	2011	Pigs	2,773	105	T. vivax	PCR
Eastern Africa	Kenya	Wissmann	2011	Pigs	2,773	169	T. brucei sI	PCR
Eastern Africa	Kenya	Wissmann	2011	Pigs	2,773	1314	T. brucei rhodesiense	PCR
Eastern Africa	Kenya	Wissmann	2011	Goats	2,773	63	T. vivax	PCR
Eastern Africa	Kenya	Wissmann	2011	Goats	2,773	19	T. brucei sI	PCR
Eastern Africa	Kenya	Wissmann	2011	Goats	2,773	463	T. brucei rhodesiense	PCR
Eastern Africa	Kenya	Thumbi	2008	Cattle	103	18	T. vivax	PCR
Eastern Africa	Kenya	Thumbi	2008	Cattle	103	5	T. congolense	ITS1 PCR
Eastern Africa	Kenya	Thumbi	2008	Cattle	103	4	T. brucei	ITS1 PCR
Eastern Africa	Kenya	Thumbi	2008	Cattle	103	1	T. vivax & T. brucei	ITS1 PCR
Eastern Africa	Kenya	Thumbi	2008	Cattle	103	3	T. vivax & T. congolense	ITS1 PCR
Eastern Africa	Kenya	Thumbi	2008	Cattle	103	23	T. vivax	nested PCR
Eastern Africa	Kenya	Thumbi	2008	Cattle	103	6	T. congolense	nested PCR
Eastern Africa	Kenya	Thumbi	2008	Cattle	103	1	T. brucei	nested PCR
Eastern Africa	Kenya	Njiru	2004	Camel	549	29	T. evansi	nested PCR
Eastern Africa	Kenya	Njiru	2004	Camel	549	146	T. evansi	microscopy (MHCT)
Eastern Africa	Kenya	Njiru	2004	Camel	549	251	T. evansi	PCR
Eastern Africa	Kenya	Njiru	2004	Cattle	549	5	T. vivax	CATT
Eastern Africa	Kenya	Ngari	2020	Cattle	49,785	393	T. congolense	buffy coat-microscopy
Eastern Africa	Kenya	Ngari	2020	Cattle	49,785	94	T. brucei	buffy coat-microscopy
Eastern Africa	Kenya	Magak	2019	Cattle	304	27	T. vivax	buffy coat-microscopy
Eastern Africa	Kenya	Mbahin	2013	Cattle	584	121	T. congolense	microscopy
Eastern Africa	Kenya	Mbahin	2013	Cattle	584	78	T. vivax	microscopy
Eastern Africa	Kenya	Thumbi	2010	Cattle	103	3	T. congolense	microscopy

Table 3. Continued

Region	Country	author	year	Animal_species	denom	overall_num	Trypanosoma_species	diagnostic_tool
Eastern Africa	Kenya	Thumbi	2010	Cattle	103	20	T. vivax	PCR
Eastern Africa	Kenya	Thumbi	2010	Cattle	103	7	T. brucei	PCR
Eastern Africa	Kenya	Thumbi	2010	Cattle	103	5	T. vivax & T. congolense	PCR
Eastern Africa	Kenya	Thumbi	2010	Cattle	103	2	T. congolense	PCR
Eastern Africa	Kenya	Thumbi	2010	Cattle	103	20	T. vivax	PCR
Eastern Africa	Kenya	Thumbi	2010	Cattle	103	2	T. brucei	PCR
Eastern Africa	Kenya	Thumbi	2010	Cattle	103	5	T. vivax & T. congolense	PCR
Eastern Africa	Tanzania	Swai & Kaaya	2012	Cattle	239	8	T. vivax	microscopy
Eastern Africa	Tanzania	Swai & Kaaya	2012	Cattle	239	4	T. congolense	microscopy
Eastern Africa	Tanzania	Laohasiusitnnarong	2011	Cattle	148	8	T. congolense	PCR
Eastern Africa	Tanzania	Laohasiusitnnarong	2011	Cattle	148	3	T. vivax	PCR
Eastern Africa	Tanzania	Laohasiusitnnarong	2011	Cattle	148	1	T. brucei	PCR
Eastern Africa	Tanzania	Laohasiusitnnarong	2011	Cattle	148	44	T. brucei	LAMP-PCR
Eastern Africa	Tanzania	Nhamitambo	2017	Cattle	237	65	T. simiae	ITS1 PCR & LAMP-PCR
Eastern Africa	Tanzania	Nhamitambo	2017	Cattle	237	36	T. theileri	ITS1 PCR & LAMP-PCR
Eastern Africa	Tanzania	Nhamitambo	2017	Cattle	237	22	T. vivax	ITS1 PCR & LAMP-PCR
Eastern Africa	Tanzania	Nhamitambo	2017	Cattle	237	6	T. brucei	ITS1 PCR & LAMP-PCR
Eastern Africa	Tanzania	Nhamitambo	2017	Cattle	237	4	T. congolense	ITS1 PCR & LAMP-PCR
Eastern Africa	Tanzania	Nonga & Kambarage	2009	Cattle	350	1	T. congolense	buffy coat-microscopy
Eastern Africa	Tanzania	Nonga & Kambarage	2009	Cattle	350	5	T. vivax	buffy coat-microscopy
Eastern Africa	Tanzania	Nonga & Kambarage	2009	Cattle	350	2	T. brucei	buffy coat-microscopy
Eastern Africa	Tanzania	mugittu	2001	Cattle	390	40	T. congolense	buffy coat-microscopy
Eastern Africa	Tanzania	mugittu	2001	Cattle	390	10	T. vivax	buffy coat-microscopy
Eastern Africa	Tanzania	mugittu	2001	Cattle	390	2	T. vivax & T. congolense	buffy coat-microscopy
Eastern Africa	Tanzania	mugittu	2001	Cattle	114	71	T. congolense	Species-specific PCR
Eastern Africa	Tanzania	malulu	2017	Cattle	424	3	T. vivax	buffy coat-microscopy
Eastern Africa	Tanzania	malulu	2017	Cattle	424	7	T. congolense	buffy coat-microscopy
Eastern Africa	Tanzania	Kassian	2017	Cattle	420	24	T. congolense	microscopy
Eastern Africa	Tanzania	Kassian	2017	Cattle	420	24	T. brucei	microscopy
Eastern Africa	Tanzania	Kassian	2017	Cattle	420	15	T. vivax	microscopy
Eastern Africa	Tanzania	Kassian	2017	Cattle	420	53	T. congolense	LAMP-PCR
Eastern Africa	Tanzania	Kassian	2017	Cattle	420	46	T. brucei	LAMP-PCR
Eastern Africa	Tanzania	Kassian	2017	Cattle	420	88	T. vivax	LAMP-PCR
Eastern Africa	Tanzania	Haji	2014	Cattle	295	4	T. vivax	microscopy
Eastern Africa	Tanzania	Haji	2014	Cattle	295	2	T. brucei & T. vivax	microscopy
Eastern Africa	Tanzania	Hamill	2013	Pigs	168	6	T. vivax	PCR
Eastern Africa	Tanzania	Hamill	2013	Pigs	168	3	T. simiae	ITS1 PCR
Eastern Africa	Tanzania	Hamill	2013	Pigs	168	4	T. godfreyi	ITS1 PCR
Eastern Africa	Tanzania	Hamill	2013	Pigs	168	16	T. brucei sI	ITS1 PCR
Eastern Africa	Tanzania	Hamill	2013	Pigs	168	8	T. brucei rhodesiense	ITS1 PCR
Eastern Africa	Tanzania	Haji	2015	Cattle	295	7	T. vivax	ITS1 PCR
Eastern Africa	Tanzania	Haji	2015	Cattle	295	35	T. vivax	microscopy
Eastern Africa	Tanzania	Haji	2015	Cattle	295	2	T. brucei rhodesiense	LAMP-PCR
Eastern Africa	Tanzania	Haji	2015	Cattle	295	38	T. vivax & T. brucei	LAMP-PCR
Eastern Africa	Tanzania	Haji	2015	Cattle	295	7	T. vivax & T. congolense	LAMP-PCR

Table 3. Continued

Region	Country	author	year	Animal_species	denom	overall_num	Trypanosoma_species	diagnostic_tool
Eastern Africa	Tanzania	Simwango	2017	Cattle	1,002	128	T. vivax & T. simiae	LAMP-PCR
Eastern Africa	Tanzania	Simwango	2017	Cattle	1,002	52	T. brucei & T. vivax	nested PCR & LAMP-PCR
Eastern Africa	Tanzania	Simwango	2017	Cattle	1,002	418	T. vivax	nested PCR & LAMP-PCR
Eastern Africa	Tanzania	Simwango	2017	Cattle	1,002	209	T. brucei	nested PCR & LAMP-PCR
Eastern Africa	Tanzania	Simwango	2017	Cattle	1,002	197	T. simiae	nested PCR & LAMP-PCR
Eastern Africa	Tanzania	Simwango	2017	Cattle	1,002	100	T. theileri	nested PCR & LAMP-PCR
Eastern Africa	Tanzania	Simwango	2017	Cattle	1,002	75	T. congolense	nested PCR & LAMP-PCR
Eastern Africa	Sudan	Salim	2014	donkey	509	16	T. brucei	ITS1 PCR
Eastern Africa	Sudan	Salim	2014	donkey	509	17	T. vivax	ITS1 PCR
Eastern Africa	Sudan	Salim	2014	donkey	509	15	T. simiae	ITS1 PCR
Eastern Africa	Sudan	Salim	2014	donkey	509	6	T. congolense	ITS1 PCR
Eastern Africa	Sudan	Mossaad	2017	Camel	189	69	T. evansi	KIN-PCR
Eastern Africa	Sudan	Mossaad	2017	Camel	189	47	T. vivax	KIN-PCR
Eastern Africa	Sudan	Mossaad	2017	camel	70	41	T. evansi	Species-specific PCR
Eastern Africa	Sudan	Mossaad	2017	camel	189	58	T. vivax	Species-specific PCR
Eastern Africa	Sudan	Babeker	2014	camel	220	115	T. evansi	CATT
Eastern Africa	Sudan	Babeker	2014	camel	220	72	T. evansi	microscopy (MHCT)
Eastern Africa	Sudan	Babeker	2014	camel	220	31	T. evansi	microscopy
Eastern Africa	Sudan	Salim	2011b	cattle	210	70	T. vivax	haematocrit centrifugation technique (HCT)
Eastern Africa	Sudan	Salim	2011b	cattle	210	21	T.congolense	haematocrit centrifugation technique (HCT)
Eastern Africa	Sudan	Salim	2011b	cattle	141	28	T.vivax	ITS1 PCR
Eastern Africa	Sudan	Salim	2011b	cattle	141	27	T.congolense	ITS1 PCR
Eastern Africa	Sudan	Salim	2011b	cattle	141	52	T.brucei	ITS1 PCR
Eastern Africa	Sudan	Salim	2011b	cattle	141	31	T.simiae	ITS1 PCR
Eastern Africa	Sudan	Ali	2011	cattle	385	60	T. congolense	buffy coat-microscopy
Eastern Africa	Sudan	Ali	2011	cattle	385	13	T. vivax	buffy coat-microscopy
Eastern Africa	Sudan	Ali	2011	cattle	385	11	T. brucei	buffy coat-microscopy
Eastern Africa	Sudan	Ali	2011	cattle	385	11	T. vivax & T. congolense	buffy coat-microscopy
Eastern Africa	Sudan	Nadia	2016	cattle	97	12	T. vivax	Species-specific PCR
Eastern Africa	Sudan	Nadia	2016	cattle	97	46	T. congolense	Species-specific PCR
Eastern Africa	Sudan	Nadia	2016	cattle	97	0	T. brucei	Species-specific PCR
Eastern Africa	Sudan	Nadia	2016	cattle	97	1	T. vivax & T. congolense	Species-specific PCR
Eastern Africa	Sudan	Nadia	2016	cattle	97	1	T. congolense & T. brucei	Species-specific PCR
Eastern Africa	Sudan	Gumaa	2011	cattle	1,008	16	T. vivax	microscopy
Eastern Africa	Sudan	Salim	2011a	camel	687	244	T. evansi	ITS1 PCR & CATT
Eastern Africa	Sudan	Mossaad	2020	cattle	248	245	T. vivax	KIN-PCR
Eastern Africa	Sudan	Mossaad	2020	goats	248	208	T. vivax	KIN-PCR
Eastern Africa	Sudan	Mossaad	2020	sheep	248	243	T. vivax	KIN-PCR
Eastern Africa	Sudan	Mossaad	2020	cattle	248	59	T. evansi	KIN-PCR
Eastern Africa	Sudan	Mossaad	2020	sheep	248	173	T. evansi	KIN-PCR
Eastern Africa	Sudan	Mossaad	2020	goats	248	213	T. evansi	KIN-PCR
Eastern Africa	Sudan	Mossaad	2020	cattle	248	34	T. congolense	KIN-PCR
Eastern Africa	Sudan	Mossaad	2020	cattle	248	114	T. evansi	CATT
Eastern Africa	Sudan	Mossaad	2020	sheep	248	111	T. evansi	CATT
Eastern Africa	Sudan	Mossaad	2020	goats	248	34	T. evansi	CATT

Table 3. Continued

Region	Country	author	year	Animal_species	denom	overall_num	Trypanosoma_species	diagnostic_tool
Eastern Africa	Sudan	Mossaad	2020	cattle	248	9	T. vivax	microscopy (MHCT)
Eastern Africa	Sudan	Mossaad	2020	sheep	248	4	T. vivax	microscopy (MHCT)
Eastern Africa	Sudan	Mossaad	2020	goats	248	9	T. vivax	microscopy (MHCT)
Eastern Africa	Mozambique	Specht	2008	cattle	16,895	2,551	T. congolense	buffy coat-microscopy
Eastern Africa	Mozambique	Specht	2008	cattle	16,895	1,689	T. vivax	buffy coat-microscopy
Eastern Africa	Mozambique	Specht	2008	cattle	16,895	1,655	T. brucei sI	buffy coat-microscopy
Eastern Africa	Mozambique	Mulandane	2017	cattle	467	107	T. congolense	buffy coat-microscopy
Eastern Africa	Uganda	Weny	2017	cattle	186	28	T. theileri	microscopy
Eastern Africa	Uganda	Weny	2017	cattle	186	8	T. brucei	microscopy
Eastern Africa	Uganda	Weny	2017	goats	317	25	T. theileri	microscopy
Eastern Africa	Uganda	Weny	2017	goats	317	0	T. brucei	microscopy
Eastern Africa	Uganda	Waiswa	2004	cattle	1,309	71	T. vivax	haematocrit centrifugation technique (HCT)& Buffy coat
Eastern Africa	Uganda	Waiswa	2004	cattle	1,309	11	T. congolense	haematocrit centrifugation technique (HCT)& Buffy coat
Eastern Africa	Uganda	Waiswa	2004	cattle	1,309	2	T. vivax & T. congolense	haematocrit centrifugation technique (HCT)& Buffy coat
Eastern Africa	Uganda	Waiswa	2005	pigs	1,147	93	T. brucei	haematocrit centrifugation technique (HCT)
Eastern Africa	Uganda	Biryomumaisho	2013	cattle	1,891	38	T. vivax	buffy coat-microscopy
Eastern Africa	Uganda	Biryomumaisho	2013	cattle	1,891	7	T. congolense	buffy coat-microscopy
Eastern Africa	Uganda	Biryomumaisho	2013	cattle	1,891	14	T. brucei	buffy coat-microscopy
Eastern Africa	Uganda	Biryomumaisho	2013	cattle	1,891	2	T. vivax & T. congolense	buffy coat-microscopy
Eastern Africa	Uganda	Biryomumaisho	2013	cattle	1,891	32	T. vivax & T. brucei	buffy coat-microscopy
Eastern Africa	Uganda	Biryomumaisho	2013	cattle	1,891	4	T. congolense & T. brucei	buffy coat-microscopy
Eastern Africa	Uganda	Biryomumaisho	2013	goats	573	1	T. vivax	buffy coat-microscopy
Eastern Africa	Uganda	Biryomumaisho	2013	goats	573	1	T. congolense	buffy coat-microscopy
Eastern Africa	Uganda	Biryomumaisho	2013	goats	573	0	T. brucei	buffy coat-microscopy
Eastern Africa	Uganda	Biryomumaisho	2013	goats	573	1	T. vivax & T. congolense	buffy coat-microscopy
Eastern Africa	Uganda	Biryomumaisho	2013	goats	573	1	T. congolense & T. brucei	buffy coat-microscopy
Eastern Africa	Uganda	Biryomumaisho	2013	pigs	253	1	T. vivax	buffy coat-microscopy
Eastern Africa	Uganda	Biryomumaisho	2013	pigs	253	0	T. congolense	buffy coat-microscopy
Eastern Africa	Uganda	Biryomumaisho	2013	pigs	253	0	T. brucei	buffy coat-microscopy
Eastern Africa	Uganda	Biryomumaisho	2013	pigs	253	3	T. vivax & T. congolense	buffy coat-microscopy
Eastern Africa	Uganda	Biryomumaisho	2013	pigs	253	4	T. congolense & T. brucei	buffy coat-microscopy
Eastern Africa	Uganda	Balyeidhusa	2012	cattle	2,232	167	T. brucei	haematocrit centrifugation technique (HCT)
Eastern Africa	Uganda	Balyeidhusa	2012	dogs	113	4	T. brucei	haematocrit centrifugation technique (HCT)
Eastern Africa	Uganda	Balyeidhusa	2012	goats	501	1	T. brucei	haematocrit centrifugation technique (HCT)
Eastern Africa	Uganda	Balyeidhusa	2012	pigs	161	25	T. brucei	haematocrit centrifugation technique (HCT)
Eastern Africa	Uganda	Balyeidhusa	2012	sheep	260	3	T. brucei	haematocrit centrifugation technique (HCT)
Eastern Africa	Uganda	Balyeidhusa	2012	cattle	2,232	324	T. brucei	PCR
Eastern Africa	Uganda	Balyeidhusa	2012	dogs	113	14	T. brucei	PCR
Eastern Africa	Uganda	Balyeidhusa	2012	goats	501	16	T. brucei	PCR
Eastern Africa	Uganda	Balyeidhusa	2012	pigs	161	35	T. brucei	PCR
Eastern Africa	Uganda	Balyeidhusa	2012	Sheep	260	28	T. brucei	PCR
Eastern Africa	Uganda	Wissmann	2014	cattle	1,428	221	T. brucei sI	Species-specific PCR
Eastern Africa	Uganda	Wissmann	2014	cattle	1,428	15	T. brucei rhodesiense	Species-specific PCR
Eastern Africa	Uganda	Muhanguzi	2017	cattle	2,030	246	T. vivax	ITS1 PCR
Eastern Africa	Uganda	Muhanguzi	2017	cattle	2,030	90	T. congolense	ITS1 PCR

Table 3. Continued

Region	Country	author	year	Animal_species	denom	overall_num	Trypanosoma_species	diagnostic_tool
Eastern Africa	Uganda	Muhanguzi	2017	cattle	2,030	46	T. brucei sI	ITS1 PCR
Eastern Africa	Uganda	Muhanguzi	2017	donkey	71	4	T. vivax	ITS1 PCR
Eastern Africa	Uganda	Muhanguzi	2017	donkey	71	21	T. congolense	ITS1 PCR
Eastern Africa	Uganda	Muhanguzi	2014	cattle	57	10	T. vivax	PCR
Eastern Africa	Uganda	Muhanguzi	2014	cattle	57	1	T. brucei rhodesiense	PCR
Eastern Africa	Uganda	Magona	2008	cattle	401	40	T. brucei	haematocrit centrifugation technique (HCT)& Buffy coat
Eastern Africa	Uganda	Magona	2008	cattle	401	0	T. congolense	haematocrit centrifugation technique (HCT)& Buffy coat
Eastern Africa	Uganda	Magona	2008	cattle	401	6	T. vivax	haematocrit centrifugation technique (HCT)& Buffy coat
Eastern Africa	Uganda	Magona	2008	cattle	401	3	T. vivax & T. congolense	haematocrit centrifugation technique (HCT)& Buffy coat
Eastern Africa	Uganda	Magona	2005	cattle	1,992	28	T. brucei	haematocrit centrifugation technique (HCT)& Buffy coat
Eastern Africa	Uganda	Magona	2005	cattle	1,992	143	T. congolense	haematocrit centrifugation technique (HCT)& Buffy coat
Eastern Africa	Uganda	Magona	2005	cattle	1,992	106	T. vivax	haematocrit centrifugation technique (HCT)& Buffy coat
Eastern Africa	Uganda	Magona	2005	cattle	1,992	31	T. vivax & T. congolense	haematocrit centrifugation technique (HCT)& Buffy coat
Eastern Africa	Uganda	Magona	2004	cattle	1,475	415	T. vivax	haematocrit centrifugation technique (HCT)& Buffy coat
Eastern Africa	Uganda	Jing	2008	cattle	203	31	T. brucei	PCR
Eastern Africa	Uganda	Jing	2008	cattle	203	6	T. congolense	PCR
Eastern Africa	Uganda	Angwech	2015	cattle	816	178	T. vivax	haematocrit centrifugation technique (HCT)
Eastern Africa	Uganda	Angwech	2015	cattle	816	260	T. vivax	ITS1 PCR
Eastern Africa	Uganda	Angwech	2015	cattle	816	54	T. congolense	ITS1 PCR
Eastern Africa	Uganda	Angwech	2015	cattle	816	14	T. brucei sI	ITS1 PCR
Eastern Africa	Uganda	Angwech	2015	cattle	816	10	T. congolense & T. vivax + T. brucei	ITS1 PCR
Eastern Africa	Uganda	Magona	2002	cattle	98	7	T. brucei	microscopy
Eastern Africa	Uganda	Magona	2002	cattle	98	7	T. vivax	microscopy
Eastern Africa	Uganda	Magona	2002	cattle	98	33	T. theileri	microscopy
Eastern Africa	Uganda	Magona	2003	cattle	250	36	T. congolense	PCR
Eastern Africa	Uganda	Magona	2003	cattle	250	12	T. vivax	PCR
Eastern Africa	Uganda	Magona	2003	cattle	250	89	T. brucei	PCR
Eastern Africa	Uganda	Magona	2003	cattle	250	3	T. congolense	microscopy
Eastern Africa	Uganda	Magona	2003	cattle	250	33	T. brucei	microscopy
Eastern Africa	Uganda	Magona	2003	cattle	250	12	T. vivax	microscopy
Eastern Africa	Uganda	Alingu	2014	cattle	295	5	T. vivax	nested PCR & LAMP-PCR
Eastern Africa	Uganda	Alingu	2014	cattle	295	0	T. vivax & T. brucei sI	ITS1 PCR
Eastern Africa	Uganda	Cox	2010	cattle	35	12	T. brucei	ITS1 PCR
Eastern Africa	Uganda	Cox	2010	cattle	35	15	T. congolense	ITS1 PCR
Eastern Africa	Uganda	Cox	2010	cattle	35	8	T. vivax	ITS1 PCR
Eastern Africa	Uganda	Ahmed	2013	cattle	600	63	T. evansi & T. brucei	ITS1 PCR
Eastern Africa	Uganda	Ahmed	2013	cattle	600	0	T. congolense	Species-specific PCR
Eastern Africa	Uganda	Ahmed	2013	cattle	600	34	T. vivax	Species-specific PCR
Eastern Africa	Uganda	Ahmed	2013	cattle	600	1	T. evansi & T. brucei	Species-specific PCR
Eastern Africa	Uganda	Ahmed	2013	cattle	600	13	T. congolense	ITS1 PCR
Eastern Africa	Uganda	Ahmed	2013	cattle	600	16	T. vivax	ITS1 PCR

Table 4. Meta-analysis of tsetse and non-tsetse species in Western and Eastern Africa

Region & Ref	Tsetse/non-tsetse species	Random pooled Estimated prevalence & 95% Conf. Interval)	Measure of Heterogeneity	% of variation (I^2**)	*P*-value
		21.00% (16.00–28.00%)	106029.34	99.97	$P < 0.05$
Eastern	*G. pallidipes*	39.00% (19.00–41.00%)	104139.34	99.98	$P < 0.05$
(Ouma et al. 2000; Lehane et al. 2000; Adams et al. 2006, 2008; Sindato, Malele 2007; Hamilton et al. 2008; Malele et al. 2011; Auty et al. 2012; Nnko et al. 2017; Rodrigues et al. 2019; Ngari et al. 2020; Getahun et al. 2020; Kulohoma et al. 2020); Anteneh et al. 2017	*T. vivax*	32.00% (8.00–43.00%)	33027.39	99.98	$P < 0.05$
	T. congolense	29.00% (14.00–73.00%	45652.39	99.99	$P < 0.05$
	T. brucei	33.00% (24.00–89.00%)	11878.28	99.97	$P < 0.05$
	T. brucei & T. vivax	4.00% (2.00–6.00%)	–	–	–
(Waiswa 2005, Mohammed., Y. O., Intisar Elrayah. 2010, Adungo et al. 2020, Ngari et al. 2020)	*G. fuscipes*	36.00% (22.00–50.00%)	97232.13	99.99	$P < 0.05$
	T. vivax	36.00% (41.00–1.13%)	0.00	–	$P < 0.05$
	T. congolense	5.00% (4.00–6.00%)	0.00	–	$P < 0.05$
	T. brucei sI	1.00% (1.00–1.00%)	0.00	–	$P < 0.05$
(Sindato et al. 2007, Hamilton et al. 2008, Malele et al. 2011, Salekwa et al. 2014b, Nnko et al. 2017, Simwango et al. 2017)	*G. swynnertoni*	30.00% (19.00–59.00%)	29229.39	99.97	$P < 0.05$
	T. vivax	39.00% (47.00–50.33%)	0.00	0.00	$P < 0.05$
	T. congolense	29.00% (28.00–31.00%)	0.00	0.00	$P < 0.05$
	T. brucei	3.00% (2.00–4.00%)	0.00	0.00	$P < 0.05$
(Malele et al. 2011, Desta 2014, Salekwa et al. 2014b, Lelisa et al. 2016, Simwango et al. 2017)	*G. mortisans*	15.00% (8.00–21.00%)	342.71	98.25	$P < 0.05$
	T. vivax	6.00% (5.00–7.00%)	0.00	0.00	$P < 0.05$
	T. congolense	8.00% (5.00–11.00%)	0.00	0.00	$P < 0.05$
	T. brucei	23.00% (20.00–27.00%)	0.00	0.00	$P < 0.05$
	T. brucei & T. vivax	8.00% (6.00–10.00%)	0.00	0.00	$P < 0.05$
(Malele et al. 2011, Ngari et al. 2020)	*G. brevipalpis*	8.00% (8.00–8.00%)	157.85	87.95	$P < 0.05$
	T. vivax	8.00% (7.00–9.00%)	0.00	0.00	$P < 0.05$
	T. congolense	8.00% (7.00–9.00%)	0.00	0.00	$P < 0.05$
(Ouma et al. 2000, Ngari et al. 2020)	*G. longipennis*	1.00% (0.00–2.00%)	0.00	0.00	$P < 0.05$
	T. brucei	1.00% (0.00–2.00%)	–	–	–
(Mohammedet al. 2010, Kassa et al. 2011, Desta 2014, Fayisa et al. 2015, Haile et al. 2016, Kebede Kassaye 2016, Kedir et al. 2016, Lelisa et al. 2016, Golessa and Mekonnen 2017, Adungo et al. 2020, Getahun et al. 2020)	Stomoxys	20.00% (7.00–33.00%)	1847.61	99.57	$P < 0.05$
	T. vivax	21.00% (13.00–30.00%)	580.20	99.31	$P < 0.05$
	T. brucei	5.00% (2.00–11.00%)	0.00	0.00	$P < 0.05$
	T. evansi	4.00% (4.00–5.00%)	0.00	0.00	$P < 0.05$
	T. brucei & T. vivax	2.00% (0.00–7.00%)	0.00	0.00	$P < 0.05$
(Kassa et al. 2011, Desta 2014, Fayisa et al. 2015, Kassaye 2015, Kebede Kassaye 2016, Kedir et al. 2016, Lelisa et al. 2016, Abebe et al. 2017, Golessa and Mekonnen 2017, Getahun et al. 2020)	Tabanids	18.00% (9.00–31.00%)	1123.11	99.47	$P < 0.05$
	T. evansi	7.00% (2.00–32.00%)	1119.39	99.73	$P < 0.05$
	T. vivax	6.00% (1.00–17.00%)	1050.50	97.54	$P < 0.05$
	T. brucei	4.00% (0.00–14.00%)	85.50	90.55	$P < 0.05$
(Getahun et al. 2020)	*Pangonia rueppellii*	12.00% (1.00–25.00%)	95.25	95.54	$P < 0.05$
(Getahun et al. 2020)	*Hippobosca camelina*	9.00% (4.00–15.00%)	93.11	94.63	$P < 0.05$
	T. vivax	19.00% (31.00–48.00%)	85.56	90.55	$P < 0.05$
	T. congolense	3.00% (1.00–8.00%)	0.00	0.00	$P < 0.05$
	T. brucei	9.00% (5.00–15.00%)	0.00	0.00	$P < 0.05$
	T. brucei & T. vivax	6.00% (3.00–11.00%)	0.00	0.00	$P < 0.05$
	T. congolense & T. brucei	3.00% (1.00–8.00%)	0.00	0.00	$P < 0.05$
Western Africa	*G. palpalis*	28.00% (20.00–35.00%)	1651.17	99.03	$P < 0.05$
(Ravel et al. 2003; Mamoudou et al. 2009; Karshima et al. 2011, 2016a,b; Okoh et al. 2012; Djohan et al. 2015; Isaac et al. 2016; Tweneboah et al. 2021)	*T. congolense*	28.00% (14.00–42.00%)	387.73	98.97	$P < 0.05$
	T. vivax	23.00% (20.00–28.00%)	380.57	97.54	$P < 0.05$
	T. brucei	22.00% (5.00–40.00%)	285.67	90.54	$P < 0.05$
	T. simiae	19.00% (16.00–23.00%)	80.55	35.67	$P < 0,05$
	T. godfreyi	7.00% (4.00–12.00%)	0.00	0.00	$P < 0.05$
(Mamoudou et al. 2009, Bouyer et al. 2013, Isaac et al. 2016, Odeniran and Ademola 2018, Mulandane et al. 2020)	*G. mortisans*	21.00% (11.00–13.00%)	1948.57	99.49	$P < 0.05$
	T. vivax	22.00% (13.00–58.00%)	562.29	99.47	$P < 0.05$
	T. congolense	21.00% (8.00–51.00%)	560.62	98.27	$P < 0.05$
	T. brucei	20.00% (17.00–22.00%)	150.44	90.87	$P < 0.05$
	T. simiae	13.00% (7.00–22.00%)	0.00	0.00	$P < 0.05$
	T. godfreyi	13.00% (7.00–22.00%)	0.00	0.00	$P < 0.05$
(Okoh et al. 2012, Bouyer et al. 2013, Djohan et al. 2015, Isaac et al. 2016, Karshima et al. 2016a, Mamoudou et al. 2016)	*G. tachinoides*	9.00% (7.00–11.00%)	104.79	87.59	$P < 0.05$
	T. vivax	11.00% (9.00–12.00%)	50.86	89.56	$P < 0.05$
	T. congolense	8.00% (4.00–13.00%)	26.59	88.72	$P < 0.05$
	T. brucei	6.00% (4.00–9.00%)	25.49	0.00	$P < 0.05$
	T. congolense & T. brucei	4.00% (2.00–8.00%)	0.00	0.00	$P < 0.05$

Table 4. Continued

Region & Ref	Tsetse/non-tsetse species	Random pooled Estimated prevalence & 95% Conf. Interval)	Measure of Heterogeneity	% of variation (I^2**)	P-value
(Karshima et al. 2011; Odeniran et al. 2019a, 2021; Mulandane et al. 2020)	Tabanids	16.00% (13.00–19.00%)	185.25	86.55	$P < 0.05$
	T. congolense	13.00% (12.00–14.00%)	180.20	80.54	$P < 0.05$
	T. theileri	13.00% (12.00–14.00%)	180.20	80.54	$P < 0.05$
(Odeniran et al. 2019a)	Stomoxys	9.00% (7.00–26.00%)	1794.94	99.78	$P < 0.05$
	T. vivax	11.00% (6.00–17.00%)	0.00	0.00	$P < 0.05$
	T. evansi	2.00% (0.00–6.00%)	0.00	0.00	$P < 0.05$
	T. congolense	1.00% (0.00–5.00%)	0.00	0.00	–
	T. vivax & T. evansi	1.00% (0.00–4.00%)	0.00	0.00	–

and *G. swynnertoni* causing infections 39.00% (95% CI: 19.00–41.00%), 36.00% (95% CI: 22.00–50.00%) and 30.00% (95% CI: 19.00–49.00%) respectively (Table 4). Least infections in tsetse were caused by *G. longipennis* 1.00% (95% CI: 0.00–2.00%). *T. vivax* was the most detected *Trypanosoma* species at range. *Stomoxys* caused the most common non-tsetse causing infection with *T. vivax* again being more detected 21.00% (95% CI: 13.00–30.00%). There were also cases of *Pangonia rueppellii* 18.00% (CI: 9.00–31.00%) and *Hippobosca camelina* 9.00% (95% CI: 4.00–15.00). In Western Africa, *G. palpalis* and *G. mortisans* were more detected and had more infections at 28.00% (95% CI: 20.00–35.00%) and 21.00% (95% CI: 11.00–13.00%) respectively with *T. congolense* and *T. vivax* being detected more at 28.00 (95% CI: 14.00–42.00%) and 22.00% (CI: 13.00–58.00%). Non-tsetse species *Tabanids* were detected more at 16.00% (95% CI: 13.00–19.00%) with more *T. congolense* 13% (95% CI: 12.00–14.00%). This shows most infections reported were due to tsetse flies and less on other biting flies. *Stomoxys* were more common in Eastern than Western Africa. Other biting flies detected in Eastern Africa also causing infections were, the *Hippobosca camelina* and *Pangonia rueppellii.*

Prevalence of AAT in Two Year Period 2000–2010 and 2011–2021 in Sub-Sahara Africa

There was no statistically significant difference in the prevalence of *Trypanosoma* species for the two periods F (1,129) =1.92, $P = 0.1682$ when analyzed using one-way ANOVA. This showed prevalence rates of AAT have not changed that much during the two decades.

Risk Factors

A total of 49 studies mentioned the risk factors of AAT. Poor body condition 21.10% (95% CI: 13.90–28.20%), older animals 17.10% (95% CI: 9.60–24.70%), trypanosensitive local and exotic breeds 16.80% (95% CI: 11.80–17.90%), late rainy seasons 12.00% (95% CI: 11.00–15.00%) and male animals 11.50% (95% CI: 5.00–18.00%) were implicated to be common risk factors in animals in Eastern Africa (Table 5). In Western Africa, type of animal breed 10.30% (95% CI: 4.40–16.10%), sex 4.70% (95% CI: 2.10–7.40%), age 5.60% (95% CI: 3.10–8.10%) and seasons 3.40% (95% CI: 3.20–3.90%) were also common risk factors. However, in Western Africa and parts of Eastern Africa (Ameen et al. 2008, Ezebuiro et al. 2008, Ukwueze and Ekenma 2015, Weldegebrial et al. 2015, Mamoudou et al. 2016), there were cases of dry season and female animals being at more risk to acquire AAT than their counterparts. In Central Africa, only type of breed and seasons were reported as risk factors. Other factors reported were; accessibility to veterinary services, misuse of trypanocidal drugs and type of watering point.

Drug Resistance

A total of 30 articles reported on drug resistance and multidrug resistance in sub-Saharan countries. From Eastern Africa 14, Western Africa 12, Southern Africa 3. Overall rate of resistance was reported at 29.00% (95% CI: 24.00–35.00%) (Table 6). Country with the highest level of diminazene and isometamidium drug resistance was Ethiopia at 35.00% (95% CI: 5.00–65.00%) and 30.00% (95% CI: 2.00–58.00%) respectively, with heterogeneity (I^2** > 98.00%, $P < 0.05$). It was also the country showing the highest level of AAT prevalence in cattle and camels (Table 2). Nigeria showed high level of drug resistance at 26.00% and also reported a high AAT in cattle, sheep, and goats (Table 2). Equitorial Guinea was one of the countries with low level of resistance 4.00% (95% CI: 4.00–5.00%). It was also the country that also showed low levels of AAT in sheep and goats 12.20% and 10.20% respectively, and no reported cases in cattle. However, countries like South Africa, Gabon, and Senegal haven't reported AAT drug resistance yet. Interestingly, Senegal was the country with the lowest prevalence in cattle 4.90% (95% CI: 4.10–11.80%), while Gabon also showed a low prevalence at 6.80% (95% CI: 0.50–16.10%). Resistance based on trypanocidal drugs showed isometamidium 33.00% (95% CI: 27.00–85.00%) and 32.00% (95% CI: 24.00–34.00%) diminazene to have more resistance (Table 7). Studies on homidium drug were insufficient to perform meta-analysis. *T. congolense* had higher resistance 24.00–46.00% while *T. vivax* had 20.00–21.00% and least was in *T. brucei* 10.00–17.00%. Forest plot representation of isometamidium (Fig. 2) and diminazene (Fig. 3) resistance.

Discussion

The aim of this review was to collect information on the prevalence of AAT in different host species using different diagnosis techniques, associated risk factors, tsetse and non-tsetse prevalence, and drug resistance in sub-Saharan Africa countries from 2000–2021. Epidemiology of AAT in both large and small domestic animals and its relation to drug resistance in sub-Saharan continental level is an area that still needs to be reviewed. The results of the review showed the persistence of AAT in different countries despite eradication initiatives such as PATTEC which aims at eliminating AAT in Africa (Kabayo 2002). This could be attributed to the collapse of tsetse eradication programs in some countries (Adungo et al. 2020). In addition, It could be linked to increase and spread of drug-resistant parasites over the past years (Steverding 2008a, Chitanga et al. 2011). Prevalence varied based on the different countries of study, host animals, diagnostic method used, and species of *Trypanosoma*. Countries like Nigeria and Ethiopia had higher prevalence in cattle, camels, and goats. This is because most farmers are known to keep

Table 5. AAT risk factors in different regions

Region	Risk factor	No. of studies	Random pooled Estimated prevalence & 95% Conf. Interval)	Measure of Heterogeneity	% of variation (I^2**)	P-Value	Ref
Eastern Africa	Overall	42	19.30% (15.40–23.30%)	29721.59	99.57	$P < 0.05$	
	Body condition	13	21.10% (13.90–28.20%)	327.67	97.56	$P < 0.05$	(Ali and Bitew 2011, Bekele and Nasir 2011, Mulaw et al. 2011, Bitew et al. 2011, Mekuria and Gadissa 2011, Terefe et al. 2015a, Kebede Kassaye 2016, Lelisa et al. 2016, Degneh et al. 2017, Golessa and Mekonnen 2017, Kitila et al. 2017, Megerssa 2017, Takele and Gechere 2019)
	Age	14	17.10% (9.60–24.70%)	886.36	98.92	$P < 0.05$	(Efrem et al. 2010, Mulaw et al. 2011, M Ayana 2012, Weldegebrial et al. 2015, Asmamaw Aki and Getachew 2016, Simwango et al. 2017, Kitila et al. 2017, Megerssa 2017, Weny et al. 2018, Takele and Gechere 2019, Kelvin et al. 2019, Madalcho 2019, Aden and Kula 2020, Gerem et al. 2020)
	Type of breed	3	16.80% (11.80–17.90%)	20.85	88.41	$P < 0.05$	(Nhamitambo 2017, Weny et al. 2017)
	Season	2	15.70% (10.10–21.30%)	22.77	91.06	$P < 0.05$	(Terefe et al. 2015b, Degneh et al. 2017, Simwango et al. 2017)
	Sex	7	11.50% (5.00–18.00%)	185.01	97.58	$P < 0.05$	(Weldegebrial et al. 2015, Kebede 2016, Lelisa et al. 2016, Kitila et al. 2017, (Ali and Bitew 2011, Bekele and Nasir 2011, Mulaw et al. 2011, Bitew et al. 2011, Mekuria and Gadissa 2011, Terefe et al. 2015a, Kebede Kassaye 2016, Lelisa et al. 2016, Degneh et al. 2017, Golessa and Mekonnen 2017, Kitila 2017, Megerssa 2017, Takele and Gechere 2019,Weny et al. 2018, Kelvin et al. 2019, Madalcho 2019, Takele and Gechere 2019)
	Misuse of trypanocidal drugs	1	6.50% (4.00–9.00%)	0.00	–	$P < 0.05$	(Rutto et al. 2013)
	Herd size	1	5.60% (1.20–10.60%)	0.00	–	$P < 0.05$	
	Location	1	4.00% (1.80–6.20%)	0.00	–	$P < 0.05$	(Nonga and Kambarage 2009)
	Altitude	1	1.40% (1.00–1.73%)	0.00	–	$P < 0.05$	(Mekuria and Gadissa 2011)
Western Africa	Overall	10	10.40% (3.40–17.50%)	2291.56	99.49	$P < 0.05$	
	Type of breed	2	10.30% (4.40–16.10%)	47.68	93.94	$P < 0.05$	(Silbermayr et al. 2013, Fasanmi et al. 2014)
	Sex	4	4.70% (2.10–7.40%)	39.68	88.63	$P < 0.05$	(Ezebuiro et al. 2008, Samdi et al. 2008, Fasanmi et al. 2014, Ukwueze and Ekenma 2015)
	Age	1	5.60% (3.10–8.10%)	0.00	0.00	$P < 0.05$	(Fasanmi et al. 2014)
	Season	2	3.40% (3.20–3.90%)	39.68	88.63	$P < 0.05$	(Ameen et al. 2008, Samdi et al. 2008)
	Altitude	1	2.20% (1.30–3.00%)	0.00	0.00	$P < 0.05$	(Majekodunmi et al. 2013)
Central Africa	Overall	2	8.20% (2.60–13.83%)	39.68	85.60	$P < 0.05$	
	Breed	1	10.00% (5.65–12.55%)	0.00	0.00	–	(Maganga et al. 2017)
	Season	1	9.00% (4.56–12.55%)	0.00	0.00	–	(Mamoudou et al. 2006)

livestock, hence increasing the risk of tsetse transmitted AAT from risky zones (Lawal-Adebowale 2012, Shapiro et al. 2017, Weber et al. 2019). Cattle had the highest prevalence of AAT than other domestic animals. They are the most commonly kept domestic animals by a high population of livestock keepers and pastoralist (Lukano 2013, Alingu et al. 2014). This could also explain why most studies have

Table 6. Trypanocidal drug resistance based on the countries, drugs and *Trypanosoma* species

Ref & Country	Drugs & *Trypanosoma* species	No. of studies	Random pooled Estimated prevalence & 95% Conf. Interval)	Measure of Heterogeneity	% of variation (I^2**)	*P*-value
	Overall	30	29.00% (8.00–58.00%)	10960.87	99.87	$P < 0.05$
Ethiopia	Diminazene	8	35.00% (5.00–65.00%)	2480.92	99.64	$P < 0.05$
(Afewerk et al. 2000; Assefa and Abebe 2001; Moti et al. 2012; Dagnachew et al. 2015, 2017b; Mekonnen et al. 2018; Degneh et al. 2019; Tadele et al. 2019)	*T. congolense*	5	52.00% (18.00–87.00%)	243.74	98.77	$P < 0.05$
	T. vivax	3	20.00% (14.00–26.00%)	79.37	59.28	$P < 0.05$
(Afewerk et al. 2000; Assefa and Abebe 2001; Moti et al. 2012; Dagnachew et al. 2015, 2017b; Degneh et al. 2019; Tadele et al. 2019)	Isometamidium	7	30.00% (2.00–58.00%)	3041.37	99.70	$P < 0.05$
	T. congolense	5	45.00% (37.00–54.00%)	1379.08	99.71	$P < 0.05$
	T. vivax	4	16.00% (6.00–27.00%)	30.89	90.29	$P < 0.05$
Zambia	Diminazene	2	33.00% (8.00–51.00%)	448.43	98.66	$P < 0.05$
(Sinyangwe et al. 2004, Delespaux et al. 2008a)	*T. congolense*	2	39.00% (34.00–58.00%)	185.86	85.67	$P < 0.05$
	T. vivax	1	6.00% (0.00–12.00%)	0.00	0.00	$P < 0.05$
	T. brucei	1	6.00% (0.00–12.00%)	0.00	0.00	$P < 0.05$
(Sinyangwe et al. 2004)	Isometamidium	1	33.00% (7.00–40.00%)	409.28	98.78	$P < 0.05$
	T. congolense	1	83.00% (76.00–1.00%)	0.00	0.00	$P < 0.05$
	T. vivax	1	8.00% (1.00–14.00%)	0.00	0.00	$P < 0.05$
	T. brucei	1	8.00% (1.00–14.00%)	0.00	0.00	$P < 0.05$
Kenya	Diminazene	3	30.00% (5.00–66.00%)	18.76	75.85	$P < 0.05$
(Mugunieri and Murilla 2003, Mapenay, and Maichamo 2008, Ndung'u et al. 2020)	*T. congolense*	2	55.00% (26.00–61.00%)	180.56	90.56	$P < 0.05$
	T. brucei	1	10.00% (5.00–25.00	0.00	0.00	$P < 0.05$
Kenya	Isometamidium	2	11.00% (10.00–12.00%)	180.56	91.56	$P < 0.05$
(Mugunieri and Murilla 2003, Mapenay and Maichamo 2008)	*T. congolense*	2	34.00% (16.00–63.00%)	180.56	91.56	$P < 0.05$
Mozambique	Diminazene	2	29.00% (21.00–37.00%)	195.86	90.81	$P < 0.05$
(Jamal et al. 2005, Mulandane et al. 2018)	*T. congolense*	2	29.00% (21.00–37.00%)	195.86	90.81	$P < 0.05$
Nigeria	Diminazene	2	26.00% (12.00–36.00%)	45.48	93.40	$P < 0.05$
(Anene et al. 2006a, Odeniran et al. 2019a)	*T. congolense*	2	20.00% (12.00–31.00%)	40.85	91.56	$P < 0.05$
	T. congolense & *T. vivax*	2	1.00% (0.00–7.00%)	0.00	0.00	$P < 0.05$
Mali	Isometamidium	2	24.00% (17.00–30.00%)	175.65	85.67	$P < 0.05$
(Talaki et al. 2006, Mungube et al. 2012)	*T. congolense*	2	12.00% (11.00–12.00%)	160.55	85.55	$P < 0.05$
	T. vivax	2	11.00% (10.00–12.00%)	158.67	84.54	$P < 0.05$
Mali	Diminazene	2	11.00% (10.00–12.00%)	0.46	89.00	$P > 0.05$
(Talaki et al. 2006, Mungube et al. 2012)	*T. congolense*	2	11.00% (10.00–12.00%)	0.46	89.00	$P > 0.05$
Burkina Faso	Diminazene	2	18.00% (20.00–33.00%)	155.56	90.65	$P < 0.05$
(Chitanga et al. 2011, Vitouley et al. 2011)	*T. congolense*	2	18.00% (20.00–33.00%)	155.56	90.65	$P < 0.05$
	T. vivax	1	13.00% (22.00–28.00%)	0.00	0.00	$P < 0.05$
Cameroon	Diminazene	1	13.00% (5.00–24.00%)	0.00	0.00	$P < 0.05$
(Mamoudou et al. 2008)	*T. brucei*	1	13.00% (5.00–24.00%)	0.00	0.00	$P < 0.05$
(Mamoudou et al. 2008)	Isometamidium	1	17.00% (15.00–34.00%)	67.00	88.55	$P > 0.05$
	T. brucei	1	21.00% (9.00–31.00%)	0.00	0.00	$P < 0.05$
	T. congolense	1	14.00% (20.00–35.00%)	0.00	0.00	$P < 0.05$
Togo	Isometamidium	1	16.00% (15.00–40.00%)	0.00	0.00	$P < 0.05$
(Tchamdja et al. 2017)	*T. congolense* & *T. vivax*	1	16.00% (15.00–40.00%)	0.00	0.00	$P < 0.05$
	Diminazene	1	14.00% (6.00–27.00%)	0.00	0.00	$P < 0.05$
Tanzania	Diminazene	1	6.00% (1.00–19.00%)	0.00	0.00	$P < 0.05$
(Kibona et al. 2006)	*T. brucei*	1	6.00% (1.00–19.00%)	0.00	–	–
Guinea	Diminazene	1	4.00% (4.00–5.00%)	–	–	–
(Talaki et al. 2006)	*T. congolense*	1	4.00% (4.00–5.00%)			
(Talaki et al. 2006)	Isometamidium	1	1.00% (1.00–1.00%)	–	–	–
	T. vivax	1	1.00% (0.00–1.00%)	–	–	–

been focused on cattle and hence their high prevalence rate. In addition, most AAT transmitting vectors prefer having a blood meal from cattle (Sinshaw et al. 2006, Mulaw et al. 2011, Abebe et al. 2017).

Camels also had a high prevalence in countries like Ethiopia. This could be attributed to the fact in Ethiopia, most farmers practice camel keeping due to arid and semiarid conditions in most regions

Table 7. Trypanocidal drug resistance based on drugs and *Trypanosoma* species

Ref & Drugs	*Trypanosoma* species	No. of studies	Random pooled Estimated prevalence & 95% Conf. Interval)	Measure of Heterogeneity	% of variation (I^2**)	*P*-value
	Overall	30	29.00% (24.00–35.00%)	10960.87	99.85	$P < 0.05$
Isometamidium	Overall		33.00% (27.00–85.00)	9602.87	99.65	$P < 0.05$
(Afewerk et al. 2000, Assefa and Abebe 2001, Mugunieri and Murilla 2003, Sinyangwe et al. 2004, Jamal et al. 2005, Talaki et al. 2006, Mamoudou et al. 2008, Mapenay and Maichamo 2008, Mungube et al. 2012, Moti et al. 2012, Mulandane et al. 2018, Tadele et al. 2019, Degneh et al. 2019)	*T. congolense*	16	46.00% (24.00–45.00%)	5422.38	99.72	$P < 0.05$
(Assefa and Abebe 2001, Sinyangwe et al. 2004, Talaki et al. 2006, Vitouley et al. 2012, Dagnachew et al. 2017b, Degneh et al. 2019)	*T. vivax*	7	20.00% (14.00–29.00%)	842.32	98.93	$P < 0.05$
(Sinyangwe et al. 2004, Anene et al. 2006b, Mamoudou et al. 2008, Degneh et al. 2019)	*T. brucei*	5	10.00% (5.00–16.00%)	22.88	78.15	$P < 0.05$
Diminazene	Overall		32.00% (24.00–34.00%)	8319.59	99.54	$P < 0.05$
(Afewerk et al. 2000, Mugunieri and Murilla 2003, Sinyangwe et al. 2004, Jamal et al. 2005, Talaki et al. 2006, Delespaux et al. 2008, Mamoudou et al. 2008, Mapenay and Maichamo 2008, Chitanga et al. 2011, Vitouley et al. 2011, Mungube et al. 2012, Moti et al. 2012, Mulandane et al. 2018, Cossic et al. 2017, Odeniran et al. 2019b, Tadele et al. 2019, Degneh et al. 2019)	*T. congolense*	19	46.00% (34.00–51.00%)	8087.84	99.77	$P < 0.05$
(Assefa and Abebe 2001; Sinyangwe et al. 2004; Dagnachew et al. 2015, 2017b; Cossic et al. 2017; Degneh et al. 2019)	*T. vivax*	6	21.00% (7.00–42.00%)	31.48	80.94	$P < 0.05$
(Sinyangwe et al. 2004, Anene et al. 2006b, Kibona et al. 2006, Mamoudou et al. 2008, Degneh et al. 2019, Ndung'u et al. 2020)	*T. brucei*	5	17.00% (5.00–78.00%)	29.48	86.43	$P < 0.05$
(Tchamdja et al. 2017, Odeniran et al. 2019a)	*T. congolense* & *T. vivax*	2	2.00% (0.00–5.00)	0.00	0.00	$P < 0.05$

of the country (Getahun and Belay 2002). In addition, tsetse population is also reported to be high. The most prevalent *Trypanosoma* species causing infections in most host animals was *T. vivax* followed by *T. congolense*. This is possibly due to the species being able to be transmitted mechanically by vectors such as *stomoxys* and *tabanids*, which transmit even in absence of biological vectors (Van den Bossche et al. 1999, Desquesnes and Dia 2003). In addition, *T. vivax* is known to have a simple and short life cycle of moving from crop of tsetse through proventriculus to proboscis hence its high prevalence (Jordan 1974, Ooi et al. 2016). Both *T. congolense* and *T. vivax* are also known to have the widest geographical distribution (Ngari et al. 2020). Small ruminants and pigs were reported to be potential reservoirs for *T. brucei* sI and *T. b. rhodesiense,* which is infective in humans. This is due to them living in close contact to humans, thus possible for intertransmission.

Different diagnosis techniques were used to determine prevalence. Prevalence rate varied based on the diagnostic tool used. Using CATT, ELISA, and species-specific PCR gave a high detection and higher prevalence rates in different host animals. CATT and ELISA test reported high prevalence probably because they detect both previous and current *Trypanosome* infections. On the other hand, molecular PCR also showed higher prevalence because, it is the method that has been confirmed to have a high detection rate in both acute and chronic stage of AAT (Desquesnes 1997). Using less sensitive diagnosis techniques such as the microscopy, may have given a limited indication of the prevalence rate in some of the countries studied (Hide and Tait 2009). Buffy coat microscopy was also commonly used in most countries. This is probably because it is easy to use, cheap, and has a higher sensitivity compared to other microscopic techniques. It is also important to note that some countries have adapted the use of highly sensitive molecular techniques such as PCR (South Africa and Ghana) (Gillingwatera 2010, Nakayima et al. 2012); Nested PCR (Kenya) and ITS PCR (Kenya) (Thumbi et al. 2008). Other types of PCR adapted include RFLP-PCR and LAMP (Zambia) (Lisulo et al. 2014, Mbewe et al. 2015). Such technologies are appropriate in controlling the disease since a truer indication of the prevalence will be documented.

Stomoxys were identified as the most common non-tsetse biting flies causing most infections in sub-Saharan Africa, with *hippobosca camelina* and *Pangonia rueppellii* identified in East Africa (Kenya). Eastern Africa had more reports of non-tsetse species compared to the Western region. This could also explain the high prevalence of the AAT in Eastern Africa countries. Nevertheless, *tabanids*, *stomoxys*, and other biting flies were less common in transmitting animal trypanosomiasis compared to tsetse flies in sub-Saharan Africa. This could be due to the fact that they are mostly found in Northern Africa (Sánchez et al. 2015), which was not part of our study region. Moreover, they transmit trypanosomes mechanically hence less studies have been done on their disease transmission rates (Desquesnes et al. 2009).

Under tsetse flies, *G. pallidipes* was the species detected to cause most infections in Eastern Africa. It has been documented

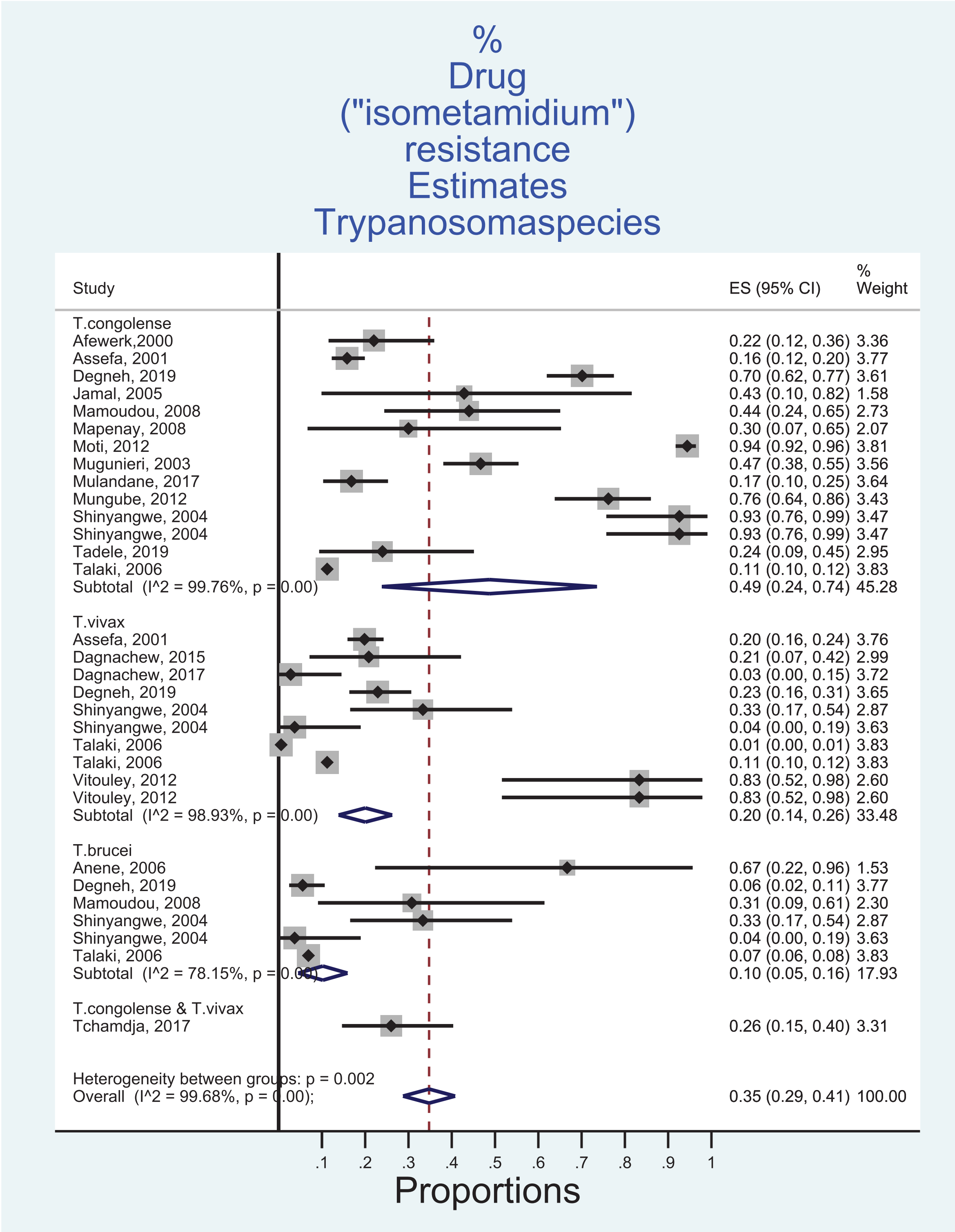

Fig. 2. Forest plot showing percentage of isometamidium drug resistance estmates in *Trypanosoma* species.

to cause more infections of human and animal trypanosomiasis (Glover 1948). This could be due to it having a high level of genetic diversity, hence making it hard to be eliminated (Ouma et al. 2011). *G. fuscipes* and *G. swynnertoni* were also prevalent. In Western Africa, *G. palpalis* followed by *G. mortisans* was identified as the common species causing infections. This could be linked to the savanna and riverine agro-ecological zones found in those regions which better suit sustainability of the different species. The most prevalent *Trypanosoma* species in tsetse flies was *T. vivax*. This can be associated with *T. vivax* having a simple life cycle and it can be transmitted mechanically too (Jordan 1974, Desquesnes and Dia 2004).

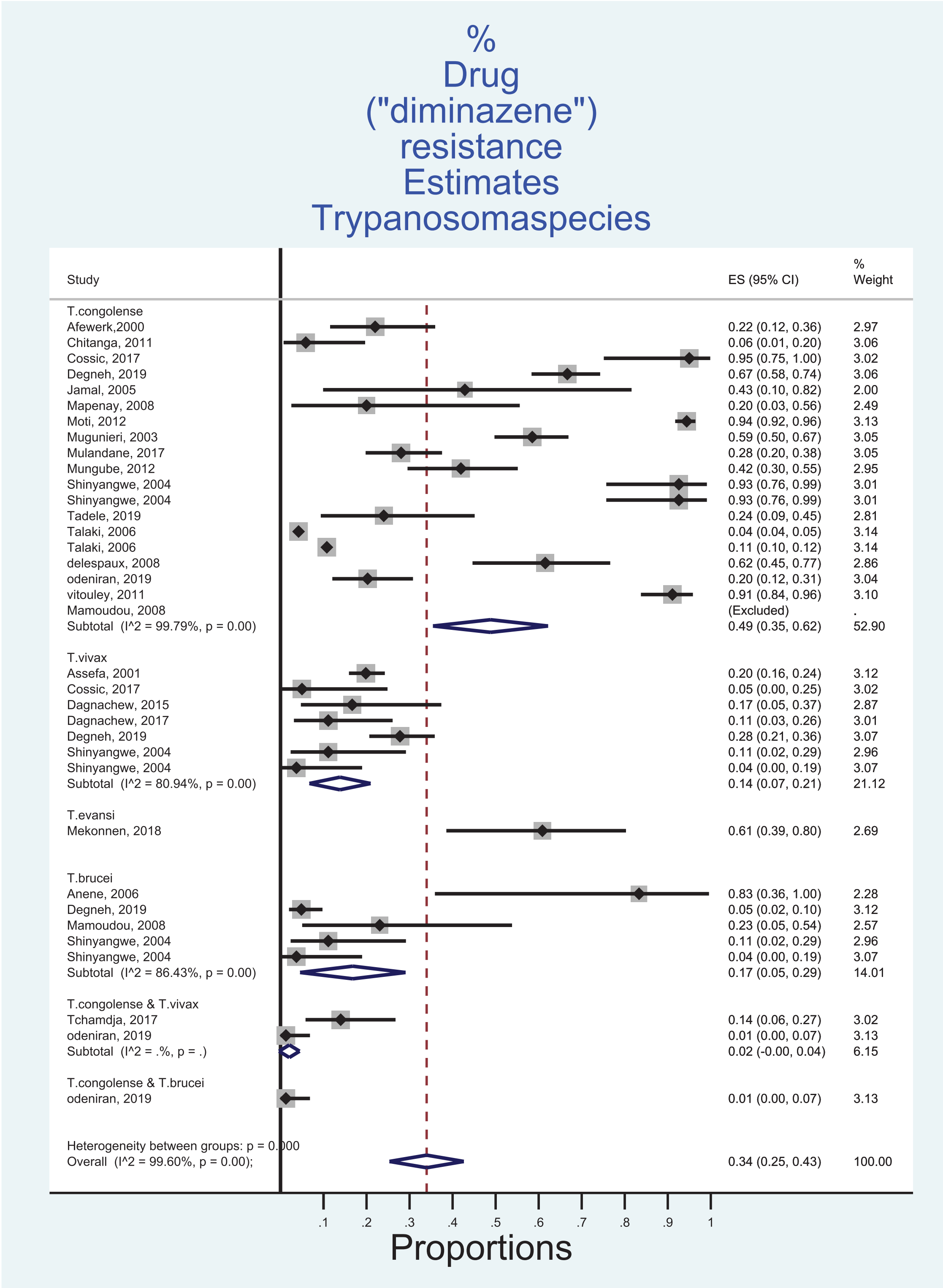

Fig. 3. Forest plot showing percentage of diminazene drug resistance estimates in *Trypanosoma* species.

Consistency in high levels of AAT prevalence over the years could be attributed to increase drug-resistant trypanosomes (Solomon and Workineh 2018), lack of consistency in control strategies and programs (Adungo et al. 2020), common risk factors, and poor practices of use of trypanocidal drugs (Dagnachew et al. 2017a).

Generally, poor body condition, trypanosensitive breeds, older, male animals, and late rainy seasons were the major risk factors. Most animals with poor body condition are considered to have a weaker immune system. This makes them more susceptible to the dangers of AAT upon bitten by an infected tsetse or other biting flies. Type of breeds has also been shown to greatly influence the infection rates. Trypanotolerant breeds like N'Dama, West Africa Shorthorn and Baoule breeds in West Africa and the Orma Boran in East Africa have the genes for resistance to animal trypanosomes (Gachohi et al. 2009, Silbermayr et al. 2013, Yaro et al. 2016). Thus, making them less susceptible than other breeds. Older animals were more susceptible to AAT due to their grazing habit. Older animals tend to move to regions that are prone to tsetse infestation in search for pasture as compared to younger animals that graze around the homesteads (Lisulo et al. 2014, Simwango et al. 2017). Wild animals in National parks are known to harbor animal trypanosomes in tsetse infested areas (Cunningham 1968), hence explaining the high risk of communally grazed and animals grazing in tsetse prone areas to acquire AAT.

Infections were higher in late rainy seasons, may be due to movement of animals and interactions with wildlife animals and tsetse and non-tsetse vectors at common grazing points, thus increasing the risk of cross-transmission and infections (Salekwa et al. 2014a). Moreover, both domestic and wild animals are more widely spread during this season thus increasing their interactions with tsetse and non-tsetse vectors. In addition, tsetse flies density and infection rates tend to vary with seasons (Nnko et al. 2017).

Countries like Ethiopia and Nigeria that showed high levels of drug resistance, also reported a high AAT prevalence in cattle, goats, and sheep. While, countries like Equitorial Guinea with high drug resistance, Gabon and Senegal with no reported cases of drug resistance were some of the countries with the lowest AAT prevalence in host animals. This shows that drug resistance could indeed be one of the factors increasing AAT reported cases in animals, and possibly tsetse and non-tsetse infection rates. A similar report has been given in a study in Burkina Faso, where increase in trypanosome drug resistance was attributed to increase in prevalence in animals (Mcdermott et al. 2003). Isometamidium and diminazene were identified as the most commonly used trypanocidal drugs with poor practices of use of these drugs being considered as one of the causes leading to their drug resistance (Dagnachew et al. 2017a). *T. congolense* followed by *T. vivax* were documented as more resistant to trypanocidal drugs possibly due to them being more diverse and pathogenic species (Tchamdja et al. 2017). However, genetic variation of drug-resistant species in most countries is still less documented.

Conclusion

In conclusion, AAT is still prevalent in most countries in sub-Saharan Africa. Country of origin, type of host animal, diagnostic method used for detection, presence of tsetse and other biting flies, risk factors, and trypanocidal drug resistance play a big role in determining the prevalence of AAT. Most countries reporting high prevalence rate also reported high levels of trypanocidal drug resistance with potential risk of spread to other regions. Cattle are the most affected domestic animals followed by camels and pigs. However, more studies should be carried out in small ruminants and detection of drug resistant species in them. Pigs, dogs, and sheep have been shown to pose as a risk of transmission of human African trypanosomiasis. This could be due to them living in close contact with humans, thus possible intertransmission can occur. Molecular PCR and serological test such as CATT and ELISA techniques have been shown to have higher sensitivity for the detection of animal trypanosomes. *Stomoxys* are the most common non-tsetse flies and transmit more AAT in sub-Saharan Africa followed by *tabanids*. Non-tsetse biting vectors are more common in Eastern than Western Africa. However, less focus was placed on identifying non-tsetse biting flies in sub-Saharan Africa and their transmission rates, and this could be due to them being mechanical transmitters. Body condition, age, sex, type of breed, and late wet seasons are factors to be considered when controlling AAT. There is an increasing incidence of drug-resistant species. Drug resistance to isometamidium chloride and diminazene aceturate is common and increasing with *T. congolense* being the most resistant species.

Recommendations

National and intercountry identification of prevalent species and genetic variation of drug-resistant species using standard molecular techniques should be applied. This will be beneficial to identify the true prevalence of AAT, identify the presence of drug-resistant species which will help improve government policy on the use of drugs, and also give an indication of transmission of drug-resistant *Trypanosoma* species across countries. Sensitizing livestock keepers on risk factors could also help control and reduce the spread of AAT. Giving more research attention to these prominent factors should help in better understanding and controlling AAT.

Acknowledgments

The authors wish to acknowledge Partnership for skills in Applied Sciences, Engineering and Technology (PASET) for offering support to I.O. to pursue her doctoral studies at SACIDS Foundation for One Health, Sokoine University of Agriculture, Morogoro, Tanzania and Virginia Polytechnic Institute & State University, College of Agriculture & Life Sciences. I.O. receives doctoral scholarship funds from Partnership for skills in Applied Sciences, Engineering and Technology Regional Scholarship innovation funds of PASET-RSIF.

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