Veterinary Parasitology 212 (2015) 460–464

Contents lists available at ScienceDirect

Veterinary Parasitology

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

Short communication

Risk factors for prevalence of pig parasitoses in Mbeya Region, Tanzania

Mwemezi Lutakyawa Kabululu[a,c,*], Helena Aminiel Ngowi[b], Sharadhuli Iddi Kimera[b], Faustin Paul Lekule[d], Eliakunda Casmir Kimbi[a], Maria Vang Johansen[e]

[a] Tanzania Livestock Research Institute (TALIRI)—Uyole, P. O. Box 6191, Mbeya, Tanzania
[b] Department of Veterinary Medicine and Public Health, Faculty of Veterinary Medicine, Sokoine University of Agriculture, P. O. Box 3021, Morogoro, Tanzania
[c] Department of Veterinary Microbiology and Parasitology, Faculty of Veterinary Medicine, Sokoine University of Agriculture, P. O. Box 3019, Morogoro, Tanzania
[d] Department of Animal Science and Production, Faculty of Agriculture, Sokoine University of Agriculture, P. O. Box 3004, Morogoro, Tanzania
[e] Section for Parasitology and Aquatic Diseases, Department of Veterinary Disease Biology, Faculty of Health and Medical Sciences, University of Copenhagen, Dyrlægevej 100, DK-1870 Frederiksberg C, Denmark

ARTICLE INFO

Article history:
Received 17 March 2015
Received in revised form 4 August 2015
Accepted 6 August 2015

Keywords:
Parasitoses
Pigs
Prevalence
Risk factors
Tanzania

ABSTRACT

A cross-sectional study was carried out to determine risk factors for prevalence of common endo- and ectoparasites of pigs kept by smallholder farmers in Mbozi and Mbeya (Rural) districts of Mbeya Region, in Tanzania. A total of 482 pigs from 220 households of 16 villages, eight in each district were randomly selected and examined. Prevalence of *Taenia solium* cysticercosis was 11.5%, gastrointestinal nematodes 63.7% and ectoparasites 21.2% based on Ag-ELISA, McMaster technique and full body searches/ear scrapings, respectively. Nematode eggs identified were strongyles (*Oesophagostomum* spp. and *Trichostrongylus* spp.), *Ascaris suum*, *Trichuris suis* and *Strongyloides ransomi* with prevalence of 57.4%, 17.5%, 5.3% and 1.1%, respectively. Four groups of ectoparasites were identified, *i.e.* lice (*Haematopinus suis*), ticks (*Rhipicephalus* spp., *Amblyomma* spp., *Haemaphysalis* spp. and *Boophilus* spp.), fleas (*Ctenocephalides canis*) and mites (*Sarcoptes scabiei* var. *suis* and *Demodex phylloides*), with prevalence of 19.1%, 2.1%, 0.4%, and 1.2%, respectively. Pigs in Mbeya (Rural) District had higher odds for porcine cysticercosis (OR = 2.63, 95% CI: [1.22–5.55]). Poor pen hygiene and infrequent antiparasitic treatment were identified to be risk factors for prevalence of nematode infections (OR = 1.95 [1.09–3.52] and OR = 1.78 [1.06–2.94], respectively). The odds for high nematode burdens increased in cases of poor pen hygiene (OR = 4.20 [2.54–6.62]) and poor feed quality (OR = 3.7 [1.66–8.33]). Pigs not treated with antiparasitic drugs within the last three months had higher odds for ectoparasite (OR = 4.0 [1.78–9.09]) and lice infestations (OR = 8.33 [1.96–14.28]) than treated pigs. This study has shown that parasitoses constitute a major burden for smallholder pigs in Mbeya Region and major risk factors included infrequent antiparasitic treatment, poor pen hygiene and poor feed quality. Cost-effective intervention strategies are needed to improve pork production, secure pig welfare and ensure safe pork for human consumption.

1. Introduction

Pig diseases are among constraints facing smallholder pig production in sub-Saharan Africa. Apart from African swine fever (ASF), parasitoses such as *Taenia solium* cysticercosis, helminthoses and ectoparasites have been mentioned as being the most important diseases (Phiri et al., 2003; Kagira et al., 2010; Nissen et al., 2011).

Pig parasitoses cause significant economic losses and compromise pig welfare and food safety. For example *T. solium* cysticercosis/taeniosis is identified as the number one food-borne parasitic zoonosis (FAO, 2014) and has been found to be responsible for substantial economic losses in endemic areas (Carabin et al., 2006). On the other hand, gastrointestinal (GI) nematodes and ectoparasites have been found to reduce growth rate for up to 30% (Ajayi et al., 1988; Elbers et al., 2000). The aim of this study was therefore, to determine prevalence and burden of, and iden-

* Corresponding author at: TALIRI—Uyole, P. O. Box 6191, Mbeya, Tanzania. Fax: +255 252 2510091.
E-mail addresses: mwemezie@yahoo.com, mwemezie@gmail.com (M.L. Kabululu).

http://dx.doi.org/10.1016/j.vetpar.2015.08.006
0304-4017/

tify risk factors for parasites of major importance in pigs kept in smallholder settings in Mbeya Region, Tanzania.

2. Materials and methods

2.1. Study area

This study was conducted in Mbozi and Mbeya (Rural) districts of Mbeya Region which is located between latitudes 8°14 and 9°24′S and longitudes 32°04 and 33°49′E. Mbeya Region has a subtropical climate with an altitude of between 900 and 2750 meters above sea level, an average temperature of 16 °C and an annual average precipitation of 900 mm. Rainy season extends from November to May with the heaviest rain from December to March. In 2007/2008 pig populations were recorded to be 117,483 in Mbozi District and 31,190 in Mbeya District (URT, 2012).

2.2. Study design and selection of study units

This study was conducted between June and July 2013 using a cross sectional design. Depending on the willingness of the pig keepers to participate, eight villages per district were purposively selected, from a randomly selected sub list of villages keeping relatively high number of pigs (above 50). In each village, all willing pig keepers were recruited. A total of 220 households were included for the study, 119 in Mbozi District and 101 in Mbeya (Rural) District. For a questionnaire survey, interviewees included a household member owning and/or taking care of pigs. For sample collection, a maximum of four pigs per household were randomly selected. Sows/gilts in late pregnancy and piglets younger than three months of age were excluded.

2.3. Data collection

Samples collected included blood and faecal samples, ectoparasite specimens and ear skin scrapings. Household data related to pig management was collected using a questionnaire administered as an interview. Information inquired included age of pigs, types of feeds and history of antiparasitic treatment within the last three months. Pigs aged three to four months were categorized as weaners, five to eight months as growers and over eight months as adults. Feed type was categorized as improved or basal depending on whether it contained protein and/or mineral supplements or not.

Body condition was categorized as good, moderate or poor, based on level of muscle/fat deposition determined by palpation. A pig was considered to be totally confined if it was kept in a pen from which it could not escape, semi-confined if it was tethered or in a pen from which it could escape and free ranging if it was freely roaming. Pen floors were classified as ground (earthed or concrete) or raised. Pen hygiene status was categorized as good, moderate or poor, based on levels of dung accumulation on the floor.

2.3.1. Blood sample collection

Blood was collected from each pig, from an external jugular vein or cranial vena cava into a plain vacutainer tube. Harvested sera samples were analyzed by using sandwich antigen–enzyme linked immunosorbent assay (Ag-ELISA) as described by Brandt et al. (1992) and modified by Dorny et al. (2004) and Sikasunge et al. (2007). Two monoclonal antibodies were used; B158C11A10 diluted at 11.8 mg/ml in carbonate buffer (0.06 M, pH 9.6) was used for coating and a biotinylated MoAb B60H8A4 diluted at 3.2 mg/ml in phosphate buffered saline-Tween 20 (PBS-T20) + 1% new born calf serum (NBCS) was used as a detector antibody. Streptavidin horseradish peroxidase diluted at 1/10,000 in PBS-T20/1% NBCS was added to act as conjugate. The plates were read using an ELISA reader at 492 nm.

2.3.2. Faecal sample collection

Faecal samples were collected from the rectum and were refrigerated until examination within 5 days. McMaster technique was employed to establish egg counts (eggs per gram) as described by Urquhart et al. (1996). Copro-cultures were set up for pooled strongylid positive samples for genus differentiation according to Thienpont et al. (1986).

2.3.3. Ectoparasite sample collection

Full body skin searches were done and ectoparasites were collected for further identification according to Soulsby (1982). For mange mites, a deep skin scraping was performed inside the pinna of a left ear. The scraped material was mixed with 10% aqueous KOH and the mixture was left to stand for an hour before microscopic examination (40×).

2.4. Ethical considerations

Permission to conduct this study was obtained from the Sokoine University of Agriculture as well as from district and village authorities. Farmers gave informed verbal consent to participate in the study. Animals handling adhered to good animal practice stipulated by OIE.

2.5. Data analysis

Prevalence data was analyzed using a Chi square test or a Fisher's exact test. Student's *t*-test and General Linear Models (GLM) procedures of SAS® (Statistical Analysis Software, 2003, version 9.1.3) were used to test for significance of associations between log transformed ($\log_{10}[x+0.5]$) faecal egg counts and categorical independent variables, with Tukey as a *post hoc* test. Stepwise selection method of logistic regression analysis was used to examine risk factors associated with the parasitoses. Entry and stay criteria were set at 0.30 and 0.35, respectively.

3. Results

3.1. Prevalence of the parasitoses

A total of 482 pigs were examined, out of which 55 (11.5%, 95% CI: [8.8–14.7]) were infected with porcine cysticercosis (PC), 302 (63.7% [59.2–68.0]) had nematode eggs, and 102 (21.2% [17.4–24.8]) were infested with ectoparasites. Four types of nematodes eggs were identified, strongylids, *Ascaris suum*, *Trichuris suis* and *Strongyloides ransomi* eggs, at a prevalence of 57.4% [52.8–61.9], 17.5% [14.2–21.2], 5.3% [3.4–7.7] and 1.1% [0.3–2.4], respectively. Copro-culture revealed two strongyle genera, *Oesophagostomum* spp. and *Trichostrongylus* spp.

Four groups of ectoparasites were identified, lice, ticks, fleas, and mites with prevalence of 19.1% [15.7–22.9], 2.1% [1.0–3.8], 0.4% [0.05–1.5] and 1.2% [0.3–2.4], respectively. *Haematopinus suis* was the only type of lice found, while four genera of ticks were identified which included *Rhipicephalus* spp., *Amblyomma* spp., *Haemaphysalis* spp. and *Boophilus* spp. Two species of mites were identified, *Sarcoptes scabiei* var. *suis* and *Demodex phylloides*. Only one species of flea was found, *Ctenocephalides canis*.

3.2. Risk factors for the parasitoses

Pigs in Mbeya (Rural) District were found to be in higher risk of PC infection than those in Mbozi District (OR = 2.63, 95% CI: