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Animal and human tungiasis-related knowledge and treatment practices among animal keeping households in Bugiri District, South-Eastern Uganda

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ABSTRACT

Background: Zoonotic tungiasis caused by *Tunga penetrans* remains a serious public and animal health problem among endemic villages in Uganda and many sub Saharan African countries. Studies on human and animal tungiasis-related knowledge and treatment practices in endemic communities have never been undertaken, a limitation to development of sustainable control measures.

Methods: A cross sectional study using semi-structured questionnaires (Supplementary file S1) was conducted among 236 animal rearing households in 10 endemic villages in Bugiri District, South-Eastern Uganda. Focus group discussions and observation checklists were used to validate and clarify the findings.

Results: Most respondents knew the aetiology (89.4%), clinical signs (98%) and the ecology of *T. penetrans* as well as the major risk factors of human tungiasis (65.2%). In contrast, very few respondents were aware of animal tungiasis. Only 4.8% of those with infected animals on the compound knew that some of their animals were infected and 13.6% of the respondents had ever seen tungiasis-affected animals. Pigs (13.1%, n = 31) and dogs (0.85%, n = 2) were the only *T. penetrans* animal hosts known to animal owners. Affected humans were treated by extraction of embedded sand fleas using non-sterile sharp instruments in all households that reported occurrence of human tungiasis at least once (n = 227). Also, affected animals were mainly treated by mechanical removal of embedded sand fleas in households that have ever experienced animal tungiasis (four out of 12; 33.3%). In a few instances, plant and animal pesticides (n = 3) and other chemicals such as grease, paraffin and wood preservative (n = 3) were also used to treat animal tungiasis.

Conclusion: The study revealed a high level of knowledge on human tungiasis but inadequate knowledge on the zoonotic nature of tungiasis. Commonly applied methods for treatment of human and animal tungiasis are a health hazard by themselves. Concerted i.e. One Health-based efforts aiming at promoting appropriate treatment of tungiasis, adequate living conditions and increased awareness on tungiasis in the communities are indicated in order to eliminate tungiasis-associated disease.

1. Introduction

Infection with the female sand flea, *Tunga penetrans*, causes an inflammatory and debilitating skin disease. Tungiasis occurs in a wide range of mammals (Heukelbach et al., 2004; Mutebi et al., 2015) including humans (Pampiglione et al., 2009). Tungiasis-associated morbidity causes acute and chronic inflammation, fissures, ulcers, deformation and loss of nails/claws which eventually may lead to mutilation of the feet and disability (Mazigo et al., 2010; Mitchel and Stephany, 2013). Bacterial super–infection is constant and if caused by *Clostridium tetani* or *Clostridium perfringens*, it may be fatal (Feldmeier et al., 2003; Feldmeier et al., 2002; Veraldi et al., 2014). Current treatment methods are a health hazard by themselves and increase the risk of the transmission of blood borne pathogens such as Hepatitis B Virus, Hepatitis C Virus and HIV in humans (Feldmeier et al., 2014; Heukelbach, 2006).

Currently, tungiasis is prevalent in resource-poor communities in Latin America, the Caribbean and sub-Saharan Africa (Pampiglione et al., 2009). Although, epidemiological information from East Africa on tungiasis is very limited, available reports indicate that it occurs

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with high prevalence among the poor (Dassoni et al., 2014; Mazigo et al., 2012; Mwangi et al., 2015; Wafula et al., 2016). In a study in Kenya, Mwangi et al. (2015) identified lack of regular use of shoes, houses with earthen mud walls, sharing of living quarters with domestic animals and dusty floors in classrooms as significant risk factors in a multivariate analysis. Mazigo et al. (2010) reported a case of a mentally disabled person with very high parasite load (810 and 60 embedded fleas in feet and hands, respectively) leading to severe clinical presentations. In Uganda, tungiasis is endemic in all regions and periodically attains epidemic levels particularly during the dry season (Ministry of Health, 2010).

A wide spectrum of animal species are susceptible to an infection by *T. penetrans* (Mutebi et al., 2015). Besides acting as reservoirs for human infections, domestic and sylvatic animals suffer from severe morbidity (Mutebi et al., 2016a, 2016b). The persistence and outcomes of tungiasis among endemic communities is driven by a wide range of socio-economic, physical and behavioural factors (Muehlen et al., 2006; Ugbomoiko et al., 2007). Many of these factors in turn depend on the attitudes towards the disease, the level of knowledge on tungiasis as well as on practices with regard to the management of the disease (Kimani et al., 2012). It is, therefore, logical that before control measures can be designed and implemented, tungiasis-related knowledge and practices have to be investigated in the target communities.

There are only very few studies on human tungiasis-related knowledge and management practices available (Kimani et al., 2012; Winter et al., 2009) while those on animal tungiasis are non-existent. In order to inform the development of sustainable tungiasis control measures in Uganda, a study was conducted among animal rearing households in 10 purposively selected endemic villages in Bugiri District, South-Eastern Uganda aimed at assessing the level of tungiasis-related knowledge, treatment and prevention practices.

2. Materials and methods

2.1. Study area

The study was carried out in 10 purposively selected tungiasis-endemic rural villages distributed in three neighbouring parishes in Bugiri district, Busoga, South Eastern Uganda (Mutebi et al., 2015). The study villages included Busano, Isakabisolo, Busakira, Busindha, Makoma, Masolya, Namungodi, Matyama which constitute Makoma Parish; Nagongera in Bulidha Parish and Kibuye in Wakawaka parish all located in Bulidha sub county of Bugiri District. The overall prevalence of human and animal tungiasis among animal rearing households in the ten villages were 71.4% (95% CI 45.4–88.3%) and 33.9% (95% CI 28.2–40.2%), respectively (Mutebi et al., 2015). People depend mainly on rain-fed subsistence crop and animal agriculture which is largely practiced with no regard to appropriate husbandry practices.

2.2. Study design

This was a cross sectional study which applied both quantitative and qualitative methods executed from January to March 2014. The study targeted animal rearing households and these were selected using the criteria of having at least one pig, dog or cat (which were considered to be the major animal reservoirs of tungiasis at the time of the study). All households which met these inclusion criteria in all the ten study villages were included in the study. Out of estimated 3214 households in the 10 villages, 239 met the inclusion criteria and 236 were sampled. The other three declined to participate in the study.

2.3. Data collection

For consenting households, semi-structured questionnaires with both closed and open ended questions were administered to the household heads. Whenever other family members were present, they supported the household head in responding to the questions which were asked. The questionnaire contained questions on the knowledge as well as on risk factors of tungiasis, the ecology of the parasite, control of tungiasis and how affected humans and animals are treated in the community. Onsite observations guided by an observation guideline were also made in individual households to validate some responses to the questionnaire. Two focus group discussions (FGDs), one for men (12 participants) and another for women (21 participants) drawn from all the ten villages were conducted to validate, clarify and complement the data collected using the questionnaires. FGDs were conducted in the most spoken local language in the area (“Lusoga”) and lasted for two hours. Participants in the FGDs were drawn from households that did not participate in the questionnaire survey and these were mainly those that had other animal species other than pigs, dogs or cats and to avoid bias on human tungiasis related information; some participants were drawn from households without animals. Focus group discussion guides (Supplementary file S2) were used to direct the discussions. Simple and precise open ended questions aligned to the survey questionnaire were asked during the sessions. The age of participants in the FGDs ranged from 23 to 76 years. Notes on responses were taken by two different persons throughout the FGDs.

2.4. Statistical analysis

Quantitative data from the questionnaires were entered into Microsoft Excel sheets 2007, double checked against data collection tools and then transferred to Stata® Software package, Version 13 (Stata Corporation, College Station, Texas 77845 USA, stata@stata.com) for analysis. Descriptive statistics were generated. Either mean (for normally distributed data) or median (for skewed data) were used as indicators of central tendency and dispersion of data was presented as ranges. Fisher’s exact or chi-square and binomial tests (for mutually exclusive events) were used to establish the significance of differences between proportions. A Student’s *t*-test was used to ascertain if there was a significant difference in age of respondents between those who had ever encountered animal tungiasis and those who had never. Odds ratios were also computed to establish associations between independent and dependent variables. Only p-values of < 0.05 were considered to be statistically significant. Qualitative data from the FGDs proceedings was sorted, merged and summarised according to themes. Representative quotations were selected from the composite summary for presentation.

2.5. Ethical considerations

The study was presented for review and was approved by the ethical committees of the College of Veterinary Medicine, Animal Resources and Biosecurity Makerere University (Ref. VAB/REC/14/101) and the Ministry of Health, Vector Control Division (Ref.: VCD-IRC/054) before it was accredited with the National Council of Science and Technology (Ref.1621). All participants gave a written consent on accepting to participate in the study.

3. Results

3.1. Characteristics of households

The demographic information of respondents and animal species owned by the households in the study is summarised in Tables 1 and 2, respectively. The average age of the respondents was 48 years (range 15–87 years) and the median household size was 8 (range = 1–24) while the median homestead (number of households on the same compound) size was 2 (range = 1-8). The estimated mean monthly income was 118,000 Uganda shillings (range = 5000–2,000.000 Uganda Shillings).

In all the villages; sheep, goats and cattle were mainly tethered