Parasite Epidemiology and Control 1 (2016) 245–251

Contents lists available at ScienceDirect

Parasite Epidemiology and Control

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

Effect of National Schistosomiasis Control Programme on *Taenia solium* taeniosis and porcine cysticercosis in rural communities of Tanzania

Uffe Christian Braae [a,*], Pascal Magnussen [a,b], Wendy Harrison [c], Benedict Ndawi [d], Faustin Lekule [e], Maria Vang Johansen [a]

[a] Section for Parasitology and Aquatic Diseases, Department of Veterinary Disease Biology, Faculty of Health and Medical Sciences, University of Copenhagen, DK-1870 Frederiksberg, Denmark
[b] Centre for Medical Parasitology, Faculty of Health of Medical Sciences, University of Copenhagen, DK-1353 Copenhagen, Denmark
[c] Faculty of Medicine, School of Public Health, Imperial College London, United Kingdom
[d] Bora Professional Consultancy Services, Iringa, Tanzania
[e] Faculty of Agriculture, Sokoine University of Agriculture, Morogoro, Tanzania

ARTICLE INFO

Article history:
Received 17 June 2016
Received in revised form 26 August 2016
Accepted 26 August 2016
Available online 28 August 2016

Keywords:
Taenia solium
Taeniosis
Mass drug administration (MDA)
Cysticercosis
Preventive chemotherapy

ABSTRACT

Taenia solium is found throughout sub-Saharan Africa and co-endemic with schistosomiasis in many regions. *Taenia solium* leads to taeniosis and neurocysticercosis - the leading cause of preventable epilepsy globally. This study aimed to assess the effects of the National Schistosomiasis Control Programme on prevalence of taeniosis and porcine cysticercosis over a four year period in Tanzania. School-based mass drug administration (MDA) of praziquantel was carried out based on schistosomiasis endemicity. Four human and five porcine cross-sectional surveys were carried out from 2012 to 2015 in Mbozi and Mbeya district in Tanzania. Three rounds of school-based MDA of praziquantel were delivered in Mbozi and two in Mbeya. The prevalence of taeniosis and porcine cysticercosis was estimated annually. Stool samples were collected from humans and prevalence of taeniosis estimated by copro-Ag-ELISA. Blood samples from pigs were collected to estimate cysticercosis prevalence by Ag-ELISA. "Track-and-treat" of taeniosis cases was carried out after each survey. In total 12082 stool samples and 4579 porcine serum samples were collected. Significantly fewer children (≤15) from Mbozi were infected throughout the study than children from Mbeya who showed a significant decrease in copro-Ag prevalence after the first treatment only. During the final survey in Mbozi the prevalence of taeniosis in adults (1.8%) was significantly lower ($p = 0.031$, OR 0.40, CI: 0.17–0.89), compared to baseline (4.1%). The prevalence of porcine cysticercosis (8%) had also dropped significantly ($p = 0.002$, OR 0.49, CI: 0.32–0.76) in this district compared to baseline (13%), whereas no significant difference was seen in Mbeya compared to baseline. The study suggests that three rounds of MDA targeting schistosomiasis in school-aged children combined with 'track-and-treat' contributed to a reduction in prevalence of *T. solium* in this population, and also had a spillover effect on adults in treated areas as well as reducing the prevalence of *T. solium* in the intermediate pig host population. Elimination of *T. solium* in this area would require a One Health approach.

* Corresponding author.
E-mail address: braae@sund.ku.dk (U.C. Braae).

http://dx.doi.org/10.1016/j.parepi.2016.08.004

1. Introduction

The zoonotic tapeworm *Taenia solium* is prevalent throughout sub-Saharan Africa (Braae et al., 2015c), and constitutes a serious, but preventable, agricultural and public health problem. In 1993 *T. solium* taeniosis/cysticercosis was declared eradicable by the International Task Force on Disease Eradication (ITFDE), but to date no large-scale control programmes have been implemented in sub-Saharan Africa. A larger scale initiative to eliminate *T. solium* has recently been trialled in Peru (Garcia et al., 2016). Due to the zoonotic properties of *T. solium,* a cross-disciplinary One Health approach involving both the agricultural sector and the human health sector, targeting both human and porcine hosts is likely to be essential to eliminate the parasite. Models have shown prevalence to revert shortly after intervention targeting only one host (Kyvsgaard et al., 2007).

Schistosomiasis is found throughout sub-Saharan Africa and co-endemic in many areas with *T. solium* taeniosis/cysticercosis (Braae et al., 2015c). National scale control programmes targeting schistosomiasis have been implemented in over 30 African countries. In Tanzania the National Schistosomiasis Control Programme (NSCP) carries out school based MDA with praziquantel at 40 mg/kg. The frequency of administration is dependent on the prevalence of schistosomiasis, in accordance with WHO guidance. Praziquantel is also considered efficacious against taeniosis at a dose of 5–10 mg/kg (Pawlowski, 1991). Therefor there is potential for MDA using praziquantel on both helminth species.

This study aimed to investigate the impact of a school based NSCP on taeniosis and porcine cysticercosis by assessing the effect of repeated rounds of praziquantel MDA at 40 mg/kg in combination with treatment of taeniosis cases identified during the study, in two areas co-endemic for *T. solium* taeniosis/cysticercosis and schistosomiasis.

2. Materials and methods

2.1. Study design

The study consisted of multiple cross-sectional surveys carried out in the two districts Mbeya and Mbozi in Tanzania from 2012 to 2015 (Fig. 1). MDA of praziquantel at 40 mg/kg to school-aged children were carried out three times in Mbozi district and twice in Mbeya district by the NSCP.

Stool samples were collected in 14 villages from the human population and has been described elsewhere (Braae et al., 2015b), except for an additional survey preformed in July/August 2015 using identical methodology. Serum samples were collected from pigs in 22 villages and has also been described elsewhere (Braae et al., 2014), with the exception of the last two surveys carried out in July/August 2014 and July/August 2015 using identical methodology (Fig. 2).

2.2. Data collection and ELISA analyses

During each survey approximately 1500 humans and 400 pigs were targeted in each district. Human stool samples were analysed for taeniosis using the copro-Ag-ELISA (Allan et al., 1990; Mwape et al., 2012). Porcine serum samples were analysed for cysticercosis using the B158/B60 Ag-ELISA (Brandt et al., 1992; Sikasunge et al., 2007).

2.3. Ethical considerations

The National Institute for Medical Research (NIMR) in Tanzania approved the study, reference number NIMR/HQ/R.8a/Vol. IX/1216 as did the Imperial College Research Ethics Committee (ICREC), reference no. ICREC_11_3_6. Permission to conduct the study was also sought through Sokoine University of Agriculture in Morogoro, Tanzania, in addition to regional, district, and local village authorities. All treatments were carried out and overseen by the NTD secretariat of the Ministry of Health, Community Development, Gender, Elderly and Children. Prior to each survey involving humans, study villages were visited and the communities

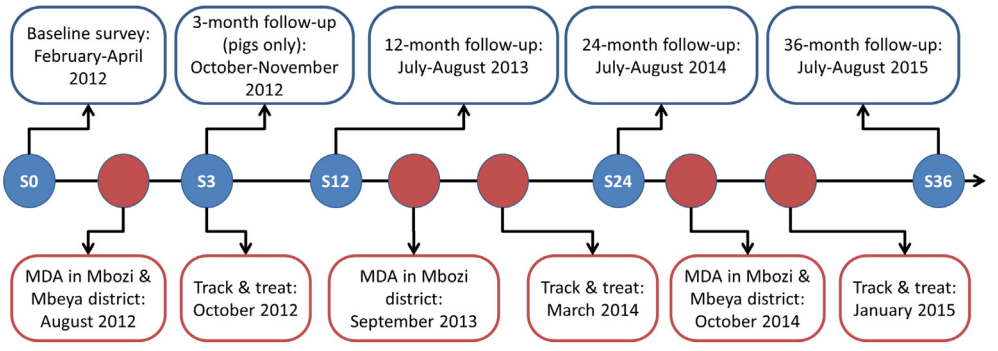

Fig. 1. Study design covering surveys (S) at month-0 (S0) to month-36 follow-up (S36) from 2012 to 2015 in Mbeya and Mbozi district, Tanzania. "Track-and-treat" was attempted on all taeniosis cases identified during the study period.