



A hyperendemic focus of *Taenia solium* transmission in the Banke District of Nepal



Keshav Sah^a, Ishab Poudel^a, Suyog Subedi^a, Dinesh Kumar Singh^b, Jo Cocker^c,
Peetambar Kushwaha^d, Angela Colston^e, Meritxell Donadeu^{f,g}, Marshall W. Lightowlers^{f,*}

^a Heifer International, G.P.O. Box 6043, Kathmandu, Nepal

^b Department of Pathology and Clinics (HOD), Tribhuvan University, Institute of Agriculture and Animal Science, Rampur Campus, Chitwan, Nepal

^c GALVmed (Global Alliance for Livestock Veterinary Medicines), Doherty Building, Pentlands Science Park, Bush Loan, Edinburgh EH26 0PZ, Scotland, UK

^d GALVmed, Unit 118 & 120 B, Splendor Forum, Plot No 3, Jasola District Centre, Jasola, New Delhi 110025 India

^e GALVmed, Galana Plaza, 4th Floor Wing C Suite B, Galana Road, Kilimani, Nairobi 00100 Kenya

^f Veterinary Clinical Centre, Faculty of Veterinary and Agricultural Sciences, University of Melbourne, 250 Princes Highway, Werribee, Victoria 3030, Australia

^g Initiative for Neglected Animal Diseases (INAND), Whitby Manor Office Estate, 14th Road, Midrand, South Africa

ARTICLE INFO

Keywords:

Taenia solium
Cysticercosis
Pig
Nepal
Banke
Necropsy

ABSTRACT

Neurocysticercosis is a major cause of epilepsy in countries where *Taenia solium* is endemic and the parasite is a major cause of food-borne disease globally. Pigs are the natural intermediate host involved in transmission of the parasite. *T. solium* is known to be endemic in Nepal, however there is limited reliable data about the prevalence of the disease in Nepal. The aim of this study was to determine accurately the prevalence of porcine cysticercosis in slaughter age pigs in an area of Nepal where pigs are known to be free-roaming. Pigs were obtained from the Udaypur Village Development Committee (VDC) and Hirminiya & Betahani VDC of the Banke district in Nepal. One hundred and ten animals of slaughter age (approximately 8–16 months old) were purchased, slaughtered and the heart, liver, brain and half the body skeletal musculature were sliced using hand knives and the number and viability of *T. solium* cysts determined. Thirty two of the 110 animals were found to harbour *T. solium* cysticerci (29%), of which 30 (27%) were found to have viable cysticerci (93% of the infected animals). This is one of the highest prevalences of porcine cysticercosis that has been reported to date from the results of necropsy on randomly selected animals. This study highlights a high rate of transmission of *T. solium* in the Banke District of Nepal. It encourages further investigation of human and porcine cysticercosis in Nepal, as well as implementation of efforts to reduce transmission of the parasite and the associated human disease.

1. Introduction

Taenia solium is a zoonotic cestode parasite which causes cysticercosis in humans. Cysticercosis is a major cause of epilepsy in many developing countries; Ndimubanzi et al. (2010) identified 29% of seizure cases to be associated with neurocysticercosis in *T. solium* endemic regions. The disease is formally recognised by the WHO as a Neglected Tropical Disease (WHO, 2010), ranked as the most important food-borne parasitic infection from a global perspective by the Food and Agriculture Organization of the United Nations (Robertson et al., 2013) and accounts for the largest proportion of the global burden of disease caused by foodborne parasites (Havelaar et al., 2015).

T. solium is transmitted in a life cycle between humans, which act as the obligate definitive host, and pigs which act as the intermediate host. Full transmission of the life cycle of *T. solium* occurs in poor countries

where pigs roam free and where meat hygiene and cultural practices favour the ingestion of poorly cooked pig meat harbouring the larval cysts.

Human neurocysticercosis is a frequently diagnosed condition in Nepal (Devleesschauwer et al., 2012; Joshi et al., 2007, 2004, 2001), where it had been estimated to be responsible for the highest burden of disease caused by a parasitic zoonosis (Devleesschauwer et al., 2014). Porcine cysticercosis is known to occur in Nepal (Joshi et al., 2007, 2001) however relatively little information is available about the prevalence of *T. solium* infection in pigs. Devleesschauwer et al. (2013b) undertook a serological survey of porcine cysticercosis in pigs slaughtered in the Kathmandu valley, finding an infection rate of up to 28%. Maharjan and Gaihre (2010) performed serology on samples from pigs in the Syangja District of the Western Development Region in Nepal and found 23.5% to be positive. The antigen ELISA and EITB serological methods that were used in these studies are now understood to have a

* Corresponding author.

E-mail address: marshall@unimelb.edu.au (M.W. Lightowlers).

<http://dx.doi.org/10.1016/j.actatropica.2017.07.022>

Received 9 May 2017; Received in revised form 20 July 2017; Accepted 20 July 2017

Available online 21 July 2017

0001-706X/© 2017 The Authors. Published by Elsevier B.V. This is an open access article under the CC BY license (<http://creativecommons.org/licenses/by/4.0/>).

higher level of false positive reactions in pigs from *T. solium* endemic areas (Develesschauer et al., 2013a; Gavidia et al., 2013; Jayashi et al., 2014; Lightowlers et al., 2016) than had previously been understood, hence the reliability of these data is unclear. The only reliable and specific method currently available for determining the prevalence of porcine cysticercosis is a detailed post mortem carcass dissection that detects cysticerci in the tissues (Lightowlers et al., 2016).

The Banke district is one of 75 districts in Nepal, located in the mid-western part of the country bordering Indian Uttar Pradesh. It is a largely rural district with 85% of its approximately 0.5 million population living in rural villages (Ministry of Agriculture and Development, Nepal, 2016). Pigs are maintained under traditional husbandry conditions by the Khatik communities, where the animals are allowed to roam freely during the daylight hours and containment in a conventional enclosure at night time. Toilets are generally not present in the communities or, where they are present, they are often not used. Pigs may be kept in stys constructed using mud and bricks, the roof usually being straw. There is limited ventilation in these stys, making conditions inside damp and humid. The animals are often left to scavenge through the country side and the suburbs, but they may also be fed. The primary sources of water are boreholes and sanitation is neglected. Farmers do not use any anthelmintic for their animals. There is a paucity of awareness regarding taeniasis/cysticercosis among these communities. Commonly, the pigs are slaughtered on-farm where they were reared and the pork, without any inspection, enters into the human food chain, through local markets. Animals are also sold to slaughterhouses in regional centres where meat inspection may identify and condemn carcasses heavily infected with *T. solium*.

In order to determine accurately the prevalence of porcine cysticercosis in a region of Nepal where *T. solium* transmission was thought likely to occur, a sample of pigs from the Banke district was investigated by detailed necropsy examination of selected organs and half the carcass musculature. The investigation was undertaken as part of a baseline study examining the effectiveness of a vaccination and chemotherapy intervention for porcine cysticercosis.

2. Materials and methods

2.1. Study design

A baseline survey was conducted in 184 pig rearing households in Udaypur Village Development Committee (VDC) and Hirminiya & Betahani VDC of the Banke district in Nepal (81°37'E–81°42'E, 27°90'N–28°20'N). These regions were selected because they were known to contain Dalit communities having many free-roaming pigs. The GPS coordinates of households were recorded together with household particulars, and a questionnaire completed concerning use of latrines or toilets, pig management and care, and knowledge and awareness of taeniasis and neurocysticercosis in humans and of cysticercosis in pigs. A randomized list of 110 household was obtained and one slaughter weight pig from each household was purchased in order to undertake post mortem examination. Typically, the households had only a single slaughter-weight animal that was available for purchase. The animals selected for post mortem may have been confined for part of the day, or of the year, but were not housed or confined for their entire life span. These included 55 animals from Udaipur, 31 animals from Hirmaniya and 24 animals from Betahani. The majority of the pigs were indigenous breeds. The age of the animals was recorded based on advice from the animal owners. The animal weight was estimated by experienced staff.

2.2. Post mortem procedures

The animals were transported to a licensed commercial abattoir in Nepalgunj Municipality, Banke where they were euthanized by slaughter house staff according to normal commercial practices. The

viscera were removed and the heart, liver, both kidneys and the full diaphragm retained in numbered containers. The carcass was divided cranio-caudally. The organs and the right hand half of the carcass, including the complete head, were refrigerated overnight at 4 °C, after which the carcass was skinned. The head was removed and the tongue, masticatory muscles (both right and left sides) and brain removed and retained. The muscles from the right hand side of the carcass were dissected from the bones, keeping separate the muscles of the forelimb.

2.3. Examination for *Taenia solium* cysts

Except in cases of very heavy infection, all the retained organs and muscles were sliced by hand at intervals of approximately 3 mm and examined meticulously for the presence of *T. solium* cysticerci or other lesions. Cysticerci were recorded as viable where they were translucent vesicles filled with transparent fluid and having a visible white scolex. Non-viable lesions were recorded separately in cases where vesicles were non-translucent, containing a dense white or yellowish fluid and having no scolex and in cases of fibrosed or calcified lesions. In cases where it was clear that a carcass contained thousands of cysts, all of the heart, liver, kidneys, diaphragm, tongue, masticatory muscles, forelimb and brain were sliced and counted as above. The remaining carcass musculature was weighed and representative samples from different muscle sites were selected representing approximately 1 kg. This sample was weighed accurately and then sliced and counted as above.

2.4. Estimation of the burden of *Taenia solium* in each carcass

For carcasses where all the musculature from the right half of the carcass was sliced, the numbers of cysticerci in the whole carcass were estimated by doubling the number recorded in the carcass half that was sliced, and adding the number recorded for the full diaphragm, tongue, masticatory muscles, heart, liver, kidneys and brain. For carcasses having very heavy levels of infection, the total carcass burden was estimated by adding the numbers for the diaphragm, tongue, masticatory muscles, heart, liver, kidneys, and brain plus twice the number found in the foreleg, plus the numbers found in the 1 kg sample multiplied by the total weight of carcass musculature that was sampled.

2.5. Definition of a case of confirmed porcine cysticercosis

An animal was determined to be a confirmed case of porcine cysticercosis if one or more viable cysticerci were found in the muscle and/or the brain, or if more than one non-viable lesion was detected in the muscles and/or brain.

3. Results

3.1. Survey

The survey of 110 households found that they held a total of 578 pigs. The majority of households (80.9%) did not have access to latrine and 95% of the households confirmed that their pigs had access to human faeces. Most of the pigs (92.7%) were of indigenous breeds and 7.3% were crossbreed. Most pigs were free ranging and 89% penned the animals at night, 2.7% allowed their animals to be permanently free ranging, 2.7% tethered the pigs and 5.5% of the animals were reared intensively. The major reason for rearing pigs was for sale to the local market (85.5%) with 13.6% being for both home consumption and sale. An awareness regarding tapeworm infection was found in 34.5% of the households and 16.4% recognised a relationship between eating raw/undercook pork and being infected with tapeworm. Almost all households (91.8%) affirmed that they had found cysts in pig meat during meat preparation. Most households (88.2%) were aware of epilepsy, headache and skin nodules and 16% were able to relate tapeworm infection with symptoms such as epilepsy, headache and skin nodules.

Download English Version:

<https://daneshyari.com/en/article/5671018>

Download Persian Version:

<https://daneshyari.com/article/5671018>

[Daneshyari.com](https://daneshyari.com)