



Original Research

Prevalence of Porcine Cysticercosis in Four States of North East India

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Abstract

Porcine cysticercosis is an important parasitic zoonotic disease in North East India, where pork is consumed by 80-85% of the population as an important form of dietary protein. It is endemic in these areas but minimal data has been reported concerning prevalence of porcine cysticercosis. The present work was undertaken to study the prevalence of porcine cysticercosis in the three North Eastern states of Assam, Meghalaya and Arunachal Pradesh. Different pork markets of different districts of the states were selected randomly from these three states. Postmortem inspection was carried out for examining cyst-like nodules. Blood samples were collected and performed ELISA for detection of circulatory taenia spp. antibodies. Overall prevalence of porcine cysticercosis in these states of NE India was recorded 0.92 %. Highest prevalence was recorded in Meghalaya (1.73 %) followed by Arunachal Pradesh (1.39 %) and Assam (0.68 %). Sero-prevalence of porcine cysticercosis in these four states was recorded 2.72 % comprising 2.13 %, 5.37 %, 3.18 % and 1.82 % in Assam, Meghalaya, Arunachal Pradesh and Mizoram respectively. Data obtained in this study suggested presence of porcine cysticercosis in these states of North East India. These results indicate urgent necessity to implement appropriate control measures for *Taenia solium* in the study areas.

Key words: Assam, Arunachal Pradesh, Meghalaya, Mizoram, Prevalence, Porcine cysticercosis

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Introduction

Cysticercosis is considered to be a serious public health problem in endemic regions which is associated with poverty, pork consumption and poor pig husbandry practices. Porcine cysticercosis, a parasitic zoonosis caused by the metacestode larval stage of *Taenia solium*, is acquired by pigs through consumption of human faeces, feed or drinking water containing *T. solium* ova. *Taenia solium* cysticerci are commonly



found in the muscles, eye or brain (Prasad *et al.*, 2008). Because pigs are the primary intermediate hosts, they are obvious targets for the implementation of control measures. In addition, the prevalence of porcine cysticercosis can be regarded as reliable indicator of active trans-boundary transmission zones among different states of North East India (NE India). Many factors influence the occurrence of this disease in these areas *viz.* presence of scavenging pigs, poor personal hygiene, lack of access to toilets in some rural/ tribal areas and urban slums, illegal and uninspected slaughtering of pigs, and consumption of partially cooked pork (Singh *et al.*, 2011, 2013). The pigs are important for food security in India and demand for pork has increased over last few years. As per recent livestock census, there are 10.29 million pigs consisting of 2.45 million crossbred and 7.84 million indigenous pigs in India (BAHS, 2014). Prevalence of porcine cysticercosis is more in underdeveloped and developing countries like India and people working in slaughter houses are at great risk to the infection during handling and processing of carcass. Identification of infected pigs with viable larvae is achieved through detection of the secreted products of viable parasites, whereas exposures, in the absence of viable parasites, are often associated with detectable levels of circulating antibody. The presence of porcine cysticercosis in an area indicates the presence of active transmission of the parasite between pigs and humans and pigs are normally targeted in order to control the problem.

The present work was undertaken to study the level of prevalence of porcine cysticercosis amongst pigs delivered for slaughter in different states of NE India.

Materials and Methods

Study Area

The study was carried out between July 2016 to November 2017 in Assam, Meghalaya and Arunachal Pradesh in order to estimate the prevalence of porcine cysticercosis in North East India. In addition to the above states, serum samples from Mizoram were also included for serological testing (Fig. 1).

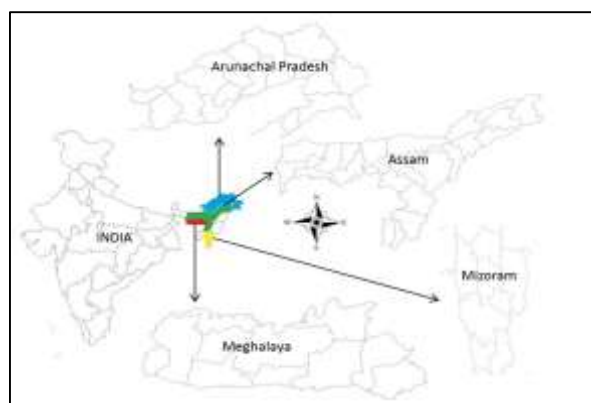


Fig. 1: Maps of Assam, Meghalaya, Arunachal Pradesh and Mizoram, the four north eastern states of India. (Map is not to scale)

Sample Collection

A total of 4556 carcass examined and 1580 blood samples collected aseptically. The total number of carcasses for the study was calculated based on the formula given by Thrusfield (2007).

$$N = \frac{Z^2 P(1 - P)}{D^2}$$

Where N is the required sample size, Z is the z-score at different confidence interval, P is the expected prevalence and D is the desired absolute precision. The samples were selected using simple random sampling method from those animals brought for slaughter on the day of examination. A 5% expected prevalence with 99% confidence interval and 1% desired absolute precision was used to determine the sample size required for the study. Hence, substituting these values the required sample size was determined to be 3152 carcasses. But to increase the precision of our estimates, the total numbers of animals included in the present study were 4556. The sample units were selected using simple random sampling method from those animals brought for slaughter on the market day.

Carcass Inspection

Tongue inspection was performed before slaughter and pig was considered positive for cysticercosis if cyst-like nodules were either seen or felt (Gonzalez *et al.*, 1990). Immediately following slaughter the presence of cysticerci in the carcass was assessed by examining *T. solium* cysticerci predilection sites, including the masseter muscles, triceps brachii muscle, tongue and liver (Fig. 2). The muscle groups excised from the half carcasses together with the complete heart, tongue, head and neck muscles, psoas muscles, diaphragm, lungs, kidneys, liver, brains and eyes. Cysts that were encountered on incisional and intact surfaces were classified and enumerated as either viable or degenerated (Boa *et al.*, 2002).

Serological Tests

Blood samples were taken before slaughter and serum was stored at -20 °C until analysis. The serum samples were analyzed for taenia spp. antibodies using RIDASCREEN® *Taenia solium* IgG kit (R-Biopharm AG, Germany) as per the manufacturer's instructions.

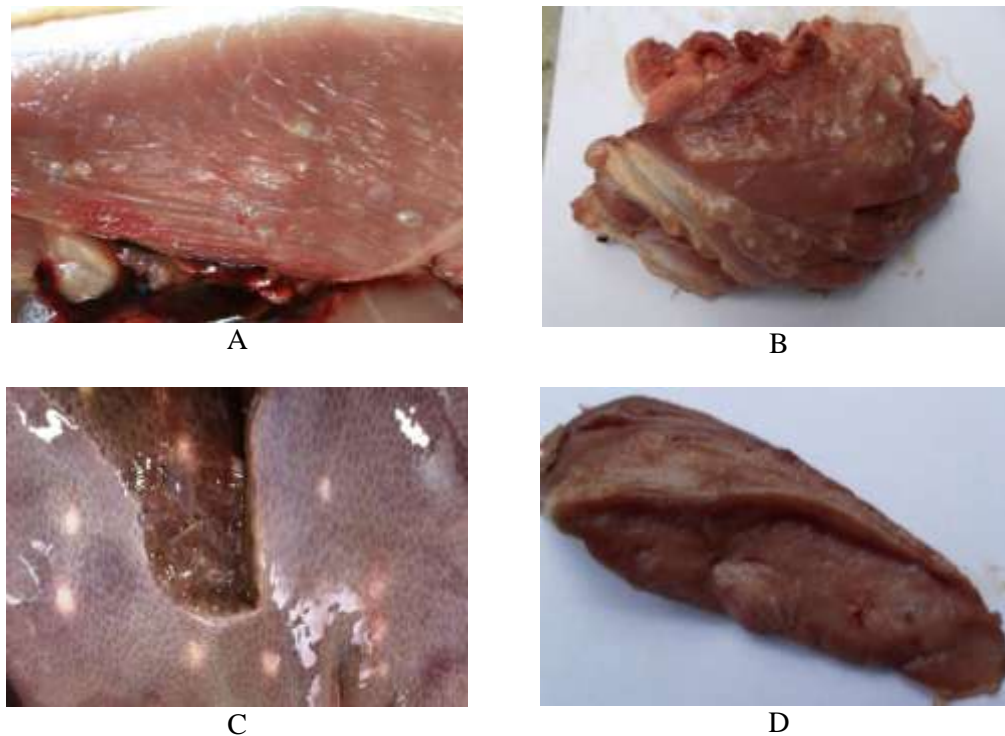


Fig. 2: Porcine cysticercosis lesions in different organs A) and B) Cyst in skeletal muscle, C) Cyst in liver D) Cysts in tongue.

Result and Discussion

Overall prevalence of porcine cysticercosis based on post-mortem inspection in these three states of NE India was recorded 0.92 % (Table 1). Higher prevalence was recorded in Meghalaya (1.73 %) followed by Arunachal Pradesh (1.39 %) and Assam (0.68 %). Higher prevalence rate in Meghalaya and Arunachal Pradesh might be due to importing of scavenging pigs from other parts of India as reported by butchers. In Meghalaya, occurrence of porcine cysticercosis was higher in Jaintia Hills Division (2.21 %). Similarly in Arunachal Pradesh, Subansiri districts showed higher cases of porcine cysticercosis (1.73 %). In Assam, prevalence of cysticercosis in Jorhat (2.26 %) was higher than other districts followed by Dhemaji (1.49 %), Morigaon (1.23 %), Sivsagar (0.94 %), Baska (0.93 %), North Lakhimpur (0.83%), Tinsukia (0.36 %), and Dibrugarh (0.28 %). Higher prevalence in Jorhat and Dhemaji districts might be due to poor hygiene and sanitary practices with scavenging pigs. Feedstuff and poor latrines may put pigs at risk of cysticercosis (Braae *et al.*, 2015). Overall sero-prevalence of porcine cysticercosis in these North Eastern states was recorded 2.72 % (Table 2). Highest sero-prevalence of porcine cysticercosis was recorded in Meghalaya (5.37 %) followed by Arunachal Pradesh (3.18 %), Assam (2.13 %) and Mizoram (1.82 %). Although, during pork inspection no cyst like lesions were observed in Kamrup (Metro) and Nagaon districts of Assam, but remarkably there are seropositive pigs recorded in both the districts.

Table 1: Prevalence rate of Porcine *Cysticercus cellulosae* cyst infection in different districts of Assam, Meghalaya and Arunachal Pradesh

Study area	Animals inspected (No.)	Cyst positive pig (%)	Organs affected
Kamrup(Metro), Assam	865	0 (0.00%)	-
Baska, Assam	215	2 (0.93%)	-
Nagaon, Assam	244	0 (0.00%)	Muscle
Morigaon, Assam	325	4 (1.23%)	Muscle
Jorhat, Assam	265	6 (2.26%)	Muscle
Dibrugarh, Assam	351	1 (0.28%)	Muscle
Tinsukia, Assam	275	1 (0.36%)	Muscle
North Lakhimpur, Assam	242	2 (0.83%)	Muscle
Sivsagar, Assam	320	3 (0.94%)	Muscle
Dhemaji, Assam	269	4 (1.49%)	Muscle
Total Assam	3371	23 (0.68%)	
Jayantia Hills Division (Juwai), Meghalaya	317	7 (2.21%)	Muscle
Khasi Hills Division (Ribhoi, East & West KH), Meghalaya	436	6 (1.38%)	Muscle
Total Meghalaya	753	13 (1.73%)	
Subansiri District (Zero & Nearby), Arunachal Pradesh	231	4 (1.73%)	Muscle, tongue
Papum pare (Itanagar & Nearby) Arunachal Pradesh	201	2 (1.00%)	Muscle, tongue
Total Arunachal	432	6 (1.39%)	
Total	4556	42 (0.92%)	

Table 2: Sero-Prevalence rate of cysticercosis in different areas of Assam, Meghalaya, Arunachal Pradesh and Mizoram

Study Area	No. of Pig Serum	Sero Positive (%)
Kamrup(Metro), Assam	203	3 (1.48%)
Baska, Assam	77	2 (2.60%)
Nagaon, Assam	96	3 (3.13%)
Morigaon, Assam	78	3 (3.85%)
Jorhat, Assam	88	1 (1.14%)
Sivsagar, Assam	53	1 (1.89%)
Dibrugarh, Assam	166	3 (1.81%)
Tinsukia, Assam	172	2 (1.16%)
North Lakhimpur, Assam	81	2 (2.47%)
Dhemaji, Assam	112	4 (3.57%)
Total Assam	1126	24 (2.13%)
Jayantia Hills Division (Juwai), Meghalaya	124	7 (5.65%)
Khasi Hills Division (Ribhoi, East & West KH), Meghalaya	118	6 (5.08%)
Total Meghalaya	242	13 (5.37%)
Subansiri District (Zero & Nearby), Arunachal Pradesh	73	3 (4.11%)
Papum pare (Itanagar & Nearby) Arunachal Pradesh	84	2 (2.38%)
Total Arunachal Pradesh	157	5 (3.18%)
Aizawl, Mizoram	55	1 (1.82%)
Total	1580	43 (2.72%)

The present study was conducted to record the prevalence of cysticercosis in pigs with large representative sample covering four states of North East India. Previously, Sarma (1977) recorded 6.64 % positive



cysticercosis from greater Guwahati of Assam. Plain (1991) recorded highest infection 11.90 % infection from North Eastern region of Assam. Borkataki *et al.* (2012) conduct study in three districts of Assam for a period of one year and found 93 pigs (9.50%) positive for cysticercosis out of 978 pigs. In Myanmar, the prevalence of porcine cysticercosis investigated by meat inspection was 23.67% and seroprevalence in farmed pigs was 15.93% (Khaing *et al.*, 2015). Kungu *et al.* (2017) recorded 12.2 % seroprevalence in rural and urban smallholder pig production settings in Uganda.

The lower prevalence rate in our study might be due to implementation of ‘Swatchh Bharat Abhiyan’ (Clean India Mission) under which one objective is making India open defecation free and real time monitoring of good hygiene and sanitary practices. High prevalence rate in Meghalaya is due to overwhelm of scavenging pigs and also might be due to importing of pigs from other parts of the country (Borkataki *et al.*, 2012). The prevalence of bovine cysticercosis was more with the ELISA than by classical meat inspection. One obvious reason is that cysticerci may easily be missed because they may not be on the cuts of muscles. ELISA has proved to be useful as a sero-epidemiological tool (Van Kerckhoven *et al.*, 1998). It will also enable epidemiological studies on herds as it permits ante mortem diagnosis (Onyango-Abuje *et al.*, 1996) and may be considered as a part of an quality control programme for determining the excellence of livestock production and developing definite standards of hygiene for farms.

Conclusion

From the current study, it can be concluded that porcine cysticercosis is prevalent in these states of North East India. Keeping in mind the zoonotic transmission of cysticercosis, awareness of public, regular meat inspection and good hygiene practices are recommended. The study also envisaged the need for routine ELISA based diagnosis at field level for early diagnosis and subsequent treatment of the disease. Therefore more studies should be carried out to further improve the knowledge based practices and transmission of *T. solium* cysticercosis in pigs in endemic areas.

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