

International Journal of Advanced Biochemistry Research



ISSN Print: 2617-4693
 ISSN Online: 2617-4707
 IJABR 2024; SP-8(2): 613-616
www.biochemjournal.com
 Received: 12-12-2023
 Accepted: 18-01-2024

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Prevalence and seroprevalence of cysticercosis in Assam

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DOI: <https://doi.org/10.33545/26174693.2024.v8.i2Sh.658>

Abstract

A study on prevalence and seroprevalence of porcine cysticercosis was conducted for a period of one year in Morigaon district and its adjoining areas *viz.* Baropujia and Pachim Nagaon of Assam. A total of 368 pigs were examined, out of which, 4 (1.09%) were found positive for infection with porcine cysticercosis. Among the three places, highest prevalence was found at Baropujia with the prevalence rate of 1.60% and lowest in Morigaon with the prevalence rate of 0.75%. Age-wise prevalence study showed highest (2.06%) in the age group of 13-18 months. Breed-wise prevalence was found more in cross bred (1.16%) than in local breed (0.92%). For the seroprevalence of porcine cysticercosis in Morigaon district, Assam, a total of 181 pig serum samples were examined by indirect ELISA using RIDASCREEN® *Taenia solium* Ig Gkit (R-Biopharm AG, Germany). Out of 181 serum samples, 10 samples were found to be positive for antibody against porcine cysticercosis with the rate of 5.52%. Highest seroprevalence was recorded at Baropujia (8.77%) and lowest at Morigaon (3.08%). Age-wise seroprevalence study showed highest (9.09%) in the age group of 13-18 months. Breed-wise seroprevalence was found more in cross bred (5.74%) than in local breed (5.08%). Seroprevalence of *Cysticercus cellulosae* infection in male and female pig was found 5.08 and 6.35 percent respectively.

Keywords: Prevalence, seroprevalence, porcine cysticercosis, Assam

Introduction

Cysticercosis is a neglected parasitic zoonotic disease, affecting mostly developing countries (Carpio *et al.* 1998) [5]. Occurrence of Taeniasis is strongly associated with poverty, poor hygiene and sanitation, free-range pig management and lack of meat inspection (Garcia *et al.* 1998) [9]. The disease mainly affects the health and livelihoods of subsistence farmers in developing countries of Asia, Africa and Latin America and it can lead to epilepsy and death in humans also. Besides these, it reduces the market value of pigs and makes pork unsafe to eat. In food animals, the disease is responsible for tremendous economic losses since moderately and heavily infected carcasses have to be totally condemned and cannot be passed for human consumption. Taeniasis due to *T. solium* plays a crucial role in the transmission of cysticercosis. Globalization possesses an increasing threat of incursions of cysticercosis and taeniasis via the increased international movement of people and importation of animals, their products and potentially contaminated produce from endemic regions. Since time immemorial the relationship of man and pig in terms of taeniasis / cysticercosis is understood and man is primarily responsible for transmission to pig whereas pig act as transmitter secondarily because pig is ignorant and speechless bears no knowledge of harbouring the organism. Now, time has come for absolute human awareness on the diseases of all classes rather than blaming the pig species.

Materials and Methods

Prevalence of Porcine Cysticercosis

The study was conducted in Morigaon district and its adjoining areas of Assam. For this, two adjoining areas namely Baropujia of Nagaon and Pachim Nagaon of Kamrup district were selected. In Morigaon district, four locations namely Garua, Mayang, Bhurbondha and Choraibahi were selected to see the prevalence of porcine cysticercosis throughout the study period (April 2019 to March 2020). A total number of 368 carcasses were examined to see the prevalence of porcine cysticercosis in the study area.

The presence of *Cysticercus cellulosae* were examined and detected after opening the pig carcasses brought for human consumption in the pork market areas as per the method of Thorton and Gracey (1974)^[22] and age, sex and breed of the carcasses were recorded. All the pigs were divided into age group of 1-6, 7-12, 13-18 and 19-24 months. Meat inspection was carried out by visual inspection of one or several predilection sites, such as heart, diaphragm, masseter muscles, tongue, neck, shoulder and intercostal and abdominal muscles. Since there is very limited pork market in the study areas, efforts were also made to visit the pig carcasses slaughtered during festivities and other social occasions for the occurrence.

Seroprevalence of porcine cysticercosis

Blood samples were collected from ear vein or cranial vena cava from live animals in plain vacutainer tubes from various parts of Morigaon district and its adjoining areas. The serum was separated from the blood samples by centrifugation and the serum samples were dispensed into aliquots and stored at -20 °C until analysis. The serum samples were analyzed for *Taenia* spp. Antibodies by indirect ELISA using RIDASCREEN® *Taenia solium* IgG kit (R-Biopharm AG, Germany) as per the manufacturer's instructions.

Result and Discussion

Prevalence of porcine Cysticercosis

A total of 368 numbers of pig carcasses were examined in different market places during the study period. Out of 368 carcasses examined, 4 were found positive for *Cysticercus cellulosae* infection with the prevalence rate of 1.09% (Table 1, Fig 1). The study was conducted in various pig markets and local huts available in Morigaon, Baropujia and Pachim Nagaon. Previously, prevalence of porcine cysticercosis was recorded 20.80% and 11.90% by Deka *et al.* (1985)^[7], and Plain (1991)^[16], from Assam. After that, Borkataki *et al.* (2012)^[4] studied the prevalence of porcine cysticercosis in Nagaon, Morigaon and Karbi Anglong district of Assam for a period of one year from March 2002 to February 2003 and recorded 7.55%, 8.20% and 13.70% infection, respectively.

Age-wise prevalence of porcine cysticercosis

Age-wise, the prevalence of *C. cellulosae* in Morigaon district and its adjoining areas has been summarized in Table 2. In the age group of 1-6, 7-12, 13-18 and 19-24 months, a total of 55, 157, 97 and 59 pig carcasses were examined respectively in the study area for the presence of *C. cellulosae*. The numbers of positive carcasses were 1 (1.82%), 1 (0.64%), 2 (2.06%) and 0 (0.00%), for the age group of 1-6, 7-12, 13-18 and 19-24 months respectively. The highest prevalence (2.06%) was found in the age group of 13-18 months and no infection was found in 19-24 months. In previous studies, Deka and Gaur (1990)^[6] and Sarti *et al.* (1992)^[19] reported that the prevalence of cysticercosis was increased with increase of age. However, many researchers (Pramanik *et al.* 1985; Pathak and Gaur 1989; Onah and Chiejina 1995)^[17, 14, 13], did not find any significant effect of age on the occurrence of *C. cellulosae*.

Breed-wise prevalence of porcine cysticercosis

Breed-wise prevalence of *C. cellulosae* in non-descriptive and crossbred pigs in the study area has been summarized in

Table 3. A total 109 non descriptive and 259 crossbred pig carcasses were examined in Morigaon district and its adjoining areas. The prevalence rate in non-descriptive and crossbred pigs was 1 (0.92%) and 3 (1.16%). The proportional distribution between non descriptive and crossbred pigs was 44% and 56%, respectively. Previously, Pramanik *et al.* (1985)^[17], recorded higher prevalence of *C. cellulosae* infection in crossbred than in indigenous animal. Similarly, Borkataki *et al.* (2012)^[4], and Kakoty and Islam (2014)^[11] also recorded higher prevalence of cysticercus infection in crossbred 12.53% and 1.38% than in local breed pigs 7.49% and 1.01% respectively. The present finding was in agreement with findings of the above workers. However, it differs with the report of Pathak and Gaur (1989)^[14], who had recorded highest prevalence rate in indigenous breed (8.90%). This finding might be due to the fact that crossbred pigs are generally less resistance to the infection compared to the local pigs.

Sex-wise prevalence of porcine cysticercosis

A total of 279 male and 89 female pig carcasses were examined during the study period. Sex-wise prevalence in male and female was 3 (1.08%) and 1 (1.12%) respectively (Table 4). In previous studies, Plain (1991)^[16] recorded higher prevalence of *C. cellulosae* in females (12.50%) than in males (11.11%) in Assam. Similarly, Borkataki *et al.* (2012)^[4], Biu and Ijudi (2012)^[3] and Kakoty and Islam (2014)^[11], also recorded prevalence of *C. cellulosae* 10.39%, 5.1% and 1.81% in females and 9.15%, 2.7% and 1.01% in males, respectively. The present finding was in agreement with findings of the above workers. However, slightly higher prevalence in males than females was recorded by Sarti *et al.* (1992)^[19] and Sharma *et al.* (2005)^[20]. On the other hand, Onah and Chiejina (1995)^[13] reported that they did not find any significant effect of sex on the occurrence of cysticerci in pigs.

Seroprevalence of porcine cysticercosis

A total of 181 numbers of serum samples from live animals were examined from the three places throughout the study period. The serum samples were analyzed for antibodies against *C. cellulosae* using RIDASCREEN® *Taenia solium* IgG kit (R-Biopharm AG, Germany) as per the manufacturer's instructions. Out of 181 samples examined, 10 were found positive for antibody against porcine cysticercosis with the prevalence rate of 5.52% (Table5). Previously, seroprevalence of porcine cysticercosis was also recorded by Vaidya *et al.* (2017)^[21] and Hafeez *et al.* (2004)^[10]. In 2017, 6.49% seroprevalence was reported by Vaidya *et al.* (2017)^[21] in Maharashtra. Similarly, Hafeez *et al.* reported 6.5%, 6.22%, 6.40% and 6.50% from Andhra Pradesh, Tamil Nadu, Karnataka and Kerala respectively. The present finding was slightly low compared to the above studies. Seroprevalence of porcine cysticercosis was found to be endemic in many countries like Zambia (Dorny *et al.* 2004)^[8], Brazil (Nieto *et al.* 2017)^[12] Colombia (Pinilla *et al.* 2018)^[15], North of Cameroon (Assana *et al.* 2010)^[2], Venezuela (Alcobedes *et al.* 2010)^[1], Madagascar (Ramahefarisoa *et al.* 2010)^[18]. In the present study lower seroprevalence rate of porcine cysticercosis was recorded which might be due to improved rearing pattern of animals, applying hygienic practices in pig farming, raising of pigs in confinement, prevention of pigs having access to human faeces and periodic deworming of the animals.



Fig 1: Cysts of *Cysticercus cellulosae* in muscle of pig carcass

Table 1: Prevalence of Porcine Cysticercosis in Morigaon district and its Adjoining areas

Place	No. of carcasses examined	No. positive	Prevalence (%)
Morigaon	133	1	0.75
Baropujia	125	2	1.6
Pachim Nagaon	110	1	0.91
Total	368	4	1.09

Table 2: Age-wise prevalence of *Cysticercus cellulosae* in pigs of Morigaon district and its adjoining areas

Age group (Months)	No. of carcasses examined	No. positive	Prevalence (%)
1-6	55	1	1.82
7-12	157	1	0.64
13-18	97	2	2.06
19-24	59	0	0.00
Total	368	4	1.09

Table 3: Breed-wise prevalence of *Cysticercus cellulosae* in pigs in Morigaon district and its adjoining areas

Place	Breed					
	Non descriptive			Crossbred		
	No. of carcasses examined	No. positive	Prevalence (%)	No. of carcasses examined	No. positive	Prevalence (%)
Morigaon	42	0	0	91	1	1.1
Pachim Nagaon	23	0	0	87	1	1.15
Baropujia	44	1	2.27	81	1	1.23
Total	109	1	0.92	259	3	1.16

Table 4: Sex-wise prevalence of *Cysticercus cellulosae* in pigs in Morigaon district and its adjoining areas

Place	Male			Female		
	No. of carcasses examined	No. positive	Prevalence (%)	No. of carcasses examined	No. positive	Prevalence (%)
Morigaon	93	1	1.08	40	0	0.00
Pachim Nagaon	88	1	1.14	22	0	0.00
Baropujia	98	1	1.02	27	1	3.70
Total	279	3	1.08	89	1	1.12

Table 5: Seroprevalence of *Cysticercus cellulosae* in pigs of Morigaon district and its adjoining areas

Place		Total Sample	Number positive	Prevalence (%)
Morigaon (No.=65)	Choraibahi (No= 15)	a. Nakhanda	05	0
		a. Kachamari	06	0
		b. Kumargaon	04	0
	Bhurbondha (No.=17)	a. Mikirbheta	06	0
		b. Hatigaon	06	01
		c. Simoluguri	05	0
	Garua (No.=21)	a. Digholbori	12	01
		b. Manipur	09	0
	Mayong (No.=12)	a. Jhargaon	03	0
		b. Boha	05	0
c. Monoha		04	0	
Adjoining areas (No.=116)	Baropujia (No.=57)	a. Torabori	22	02
		b. Jorabari	19	02
		c. Bhalukmari	16	01
	Pachim Nagaon (No.=59)	a. Kahikuchi	27	01
		b. Dhupguri	32	02
Overall		181	10	5.52

Conclusion

In conclusion, the present investigation revealed both prevalence and seroprevalence of porcine cysticercosis and human taeniasis in Morigaon district and its adjoining areas and it showed a decreasing trend of the disease. Reduction in prevalence was successfully achieved by creating awareness among human beings about hygienic measures and sanitation practices for both human beings and animals. The lower prevalence rate in the study area might also 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. In order to fully explore epidemiological pattern of the disease, efforts should be made to standardize study designs in order to produce reliable estimates to assess the burden of porcine cysticercosis and human taeniasis. Once burden estimates are available, the cost-effectiveness of prevention and control programs can be tested and help national and international policy- and decision-makers in setting priorities in public health and veterinary public health policies, services and research. Moreover, continuous efforts are required for monitoring the disease and proper implementation of veterinary and public health interventions to minimize the incidence in endemic regions.

Acknowledgement

The authors are thankful to the Dean, Faculty of Veterinary Science, AAU, Khanapara, Guwahati, Assam for the facilities provided to conduct the study.

Conflict of Interest

The authors declare no conflict of interest.

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