Seroprevalence of *Toxoplasma gondii* in mithun (*Bos frontalis*) from north eastern hilly region of India

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Abstract Mithun (*Bos frontalis*) is mostly utilized for meat purpose by the local tribal people of north eastern hilly region of India. Meat born diseases are very important issues for the people of these areas from the public health point of view. In order to realize the issues, the serological prevalence of Toxoplasmosis was carried out as per ELISA kit (CHEKIT* TOXOTEST, IDEXX Laboratory, USA) to find out *Toxoplasma gondii* antibody. As a whole, out of 195 animals examined, only 8 (4.10 %) animals were found to be suspected and one (0.51 %) animal was found to be positive in this precious animal of the north eastern region.

Keywords *Toxoplasma gondii* · ELISA · Prevalence · Mithun

Introduction

Mithun (*Bos frontalis*), the pride animal of north eastern region, belongs to order artiodactyla, class mammalia and family bovidae. The animal has a unique place in the socio-economic cultural and religious life of tribal population of this region of India. This animal is particularly important for meat purpose (Heli 1995), however importance of milk cannot be ruled out in the near future. Zoonotic diseases of these animals are very important for public health concern of mithun farmers in this area of hilly region. Among

zoonotic diseases, Toxoplasmosis affects all warm blooded animals including human being (Soulsby 1986). To understand the prevalence of zoonotic disease of mithun, present study was aimed for serological screening of Toxoplasmosis, which is very important for child as well as pregnant woman. However, reports of Toxoplasmosis are very rare in Mithun of this locality of hilly region due to confinement in deep forest. A very scanty report of seroprevalence of toxoplasmosis are available on mithun in both free ranging as well as captive condition (Rajkhowa et al. 2003, 2005, 2008). However, Rajkhowa et al. (2007), reviewed the status of parasitic infection in mithun calves in the NEHR of India.

Materials and methods

The serum samples were collected from different areas of north eastern region in both free ranging as well as semi intensively managed animals from both Jharnapani as well as Porba farm of NRC on mithun (ICAR). The samples were processed as per *T. gondii* antibody ELISA kit (CHEKIT* TOXOTEST, IDEXX Laboratory, USA). To validate the assay, the OD of the positive control (PC A450) should not exceed 2.000 and OD of the negative control (NC A450) should not exceed 0.500. The difference between the positive and the negative control (PC A40-NC A450) should not be more than 0.300. The OD of duplicates was finding out their average. The OD of the positive control (PCX) and the OD of the sample (Sample A450) are corrected by subtracting the OD of the negative control (NCX). Analyze the samples in relation to the negative and the positive control with the formula $S/P \% = 100 \times \text{Sample A450} - \text{NCX} / \text{PCX} - \text{NCX}$. The sample have been interpreted as per following indicator as $S/P: \leq 20 \%$ (Negative), ≥ 20 to ≤ 30 %

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(Suspect), ≥ 30 to ≤ 100 % (weak positive) and ≥ 100 % (positive). The statistical analyses were done as per Snedecor and Cochran (1989).

Results

In captive condition of Jharnapani farm, 114 animals were screened to find out serological prevalence of *T. gondii* antibody in animals for the year of 2011–2012. In 2011, out of 68 animals examined, 5 animals were found to be suspected as per ELISA kit interpretation of S/P %. However, none of animals were found to be positive out of 46 animals examined in 2012. In middle Khomi villages of Phek district also, all animals were found to be negative, where 18 animals have been examined. But in the same vicinity of Phek district, free ranging animals of Porba village, three animals were found to be suspected, out of 44 animals examined. In Khuwangleng villages of Champhai district of Mizoram, out of 12 animals surveyed, interestingly one animal found to be positive to *T. gondii* antibody. In Arunachal Pradesh also, 8 animals were surveyed, none of them found to be suspected or positive against this parasites.

As a whole, out of 195 animals examined, only 8 (4.10 %) animals were found to be suspected and one (0.51 %) animal found to be positive in this precious animal of north eastern region (Figs. 1, 2 and Table 1). To compare the presence of antibody, total of three animals were found to be suspected and one positive, out of 81 animals examined, while in semi intensive condition, five animals were found to be suspected out of 114 animals examined.

Discussion

Studies conducted on free-ranging mithuns of Nagaland, revealed that the overall seroprevalence of antibodies to *T. gondii* in mithun was 42 % when detected by modified direct agglutination test (Rajkhowa et al. 2008). This was contrary to our finding where very low prevalence of antibody in mithun has been found. In free ranging, only three animals were detected as suspected and one animal found to be positive for antibody. In captive condition, one hundred and four mithuns from India were tested for serum antibodies to *T. gondii* by modified direct agglutination test (Rajkhowa et al. 2005). The overall prevalence of *T. gondii* antibodies in mithun was 28 % which was comparatively much higher than this present finding (4.38 %).

The possible reason for occurrence of *T. gondii* antibodies in Porba village could be due to location of the area close to human settlements where cat's population is very high and being kept as pet animals. Besides, animals were maintained in deep forest, where wild canids like dog and

fox are serious problem for mithun rearing. Probably, these wild carnivorous animals maintained sylvatic type of infection. In the same way, Jharnapani farm is also located near human settlements, where keeping of cat at home is a household practice. Moreover, positive animals may constitute an important source of infection to human being through ingestion of meat. Because of the cultural habit of the tribal people of keeping these animals in forest and utilizing it for meat purpose, there is possibility that toxoplasmosis will transmit to human beings. Environmental factors such as presence of cats nearby mithun farms and existing climatic condition which favors' the survival of oocysts in the environment are considered to be congenial factors for the prevalence of *T. gondii* infection in mithun (Rajkhowa et al. 2005). The present findings from free ranging reveals the presence of *Toxoplasma* infection in mithun. As the collection of sample in free ranging condition is a very tough job, so the collections were done whenever opportunity arises. This study will give an indication that antibody to *T. gondii* in mithun they may act as a source of infection to other domestic animals as well as to human being. Implementations of management factors so that animals should be away from wild animals contact to reduce the sharing of the sylvatic cycle. Since, these data reveals very low prevalence of *T. gondii* antibody in mithun population which can be comparing with cattle, which are considered a poor host for *T. gondii* (Dubey 1985, 1986), perhaps due to innate resistance. The increasing demand for food safety, with potential risk of zoonotic diseases, legislation has to be made for development and standardization of early diagnostic tests for *Toxoplasma* infection in both human and animals. These potentially reduce the transmission pattern and improve health status in human beings.

In conclusion, occurrence of toxoplasmosis in field condition might be due to sharing of sylvatic life cycle of mithun with wild fox, jungle cat etc. A detailed survey on large population of mithuns and man will reveal the exact status of toxoplasmosis in mithun inhabited areas to draw a

Fig. 1 Percent seroprevalence of *T. gondii* in mithuns (*Bos frontalis*)

Fig. 2 Comparison of Seroprevalence of *T. gondii* free ranging as well as semi intensive rearing system

Table 1 Seroprevalence of *T. gondii* free ranging as well as semi intensive rearing system

Name of the place	Number of animals examined	Suspected as per ELISA kit interpretation of S/P %	Positive as per ELISA kit interpretation of S/P %
Jharnapani farm	114	5	–
Middle Khomi	18	–	–
Porba	43	3	–
Khuwangleng	12	–	1
Itanagar	8	–	–
Total	195	8 (4.10)	1 (0.51)

Table in parenthesis indicate percentage of infection

clear picture of epidemiology of *T. gondii* in both mithuns and human being of north eastern hilly region of India.

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