Prevalence of *Histomonas meleagrisidis* in Broiler Chicken in Different Parts of Mizoram, India

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Abstract: A survey was carried out to detect the overall incidence of histomoniasis in broiler birds in different parts of Mizoram, India. Out of 4000 birds examined, 40 birds were found positive for *Histomonas meleagrisidis* revealing 1% infection rate. *Heterakis gallinarum* was recovered from the caeca of positive birds. Gross lesions were found in caeca and liver. Microscopic examination of stained section of liver tissue revealed numerous circular amoeboid Histomonas meleagrisidis together with cellular infiltration. The PCR selectively amplified 209 bp of the small subunit ribosomal DNA sequence of *Histomonas meleagrisidis*.

Key words: *Histomonas meleagrisidis*, broiler chicken, histopathology, PCR

INTRODUCTION

*Histomonas meleagrisidis* is a protozoan parasite belonging to the trichomonad group which occurs all over the world (McDougald, 2005). The parasite causes high morbidity and mortality in turkeys and the disease is manifested by a diphtheroid inflammation of the caeca and by necrosis in the liver (Sentier-cue et al., 2009; Poppo et al., 2011). Besides turkeys, the parasite may occasionally affect chicken, partridge, pheasant, quail, duck and a variety of gallinacineous birds. Mortality in diseased turkeys often goes beyond 50% (Callicicet-Cardinal et al., 2001). It necessitated the culling of white flocks in the European union as no prophylactic or therapeutic antihistomonal drugs are licensed for prophylaxis or therapy of histomoniasis in food producing animals since 2003 (Poppo et al., 2012). The parasite is ingested in ova of *Heterakis gallinarum* worms or as larvae in earthworms or faeces or there is an incubation period of 15-20 days. The unprotected histomonas dies within a few hours outside the avian host and its survival on pasture is due to the protection afforded by the *Heterakis* egg. The problem is seen with highest levels in high biosecurity facilities (Lister, 2010; Aka et al., 2011). It has recently been demonstrated that infection spread rapidly via the cloaca when birds are on contaminated litter. The disease is more common during summer months (Hauck et al., 2010a). Following ingestion the histomonas invades the walls of the caeca causing marked inflammation and ulcer formation. These become much enlarged and may involve the whole of the caecal mucosa. The mucosa become greatly thickened and its surface become necrotic and the caeca contain Yellowish green, caseous exudates or a dry cheesy core. Macroscopically, both the caeca are enlarged and show haemorrhagic in appearance. Eventually the organisms enter the liver via the hepatic portal system. The liver lesion is more often circular depressed area of necrosis with raised border and up to 1cm in diameter.

Scant information on the outbreak of the disease is available in India apart from sporadic cases in fowl (Kalia, 1958; Banerjee and Yadav, 2001) and one in partridge (Mir et al., 1999). Direct demonstration of the parasite in tissue is based on the histopathological examination but is difficult when small number of parasites is present. Recently a more sensitive method based on PCR that amplified the target DNA of 209 bp of the small subunit r DNA sequence is used to characterize the parasite. The aim of our investigation was to present overall incidence of Histomoniasis in Mizoram, India and to establish a conventional PCR to examine its specificity as well as sensitivity in the diagnosis of histomoniasis.

MATERIALS AND METHODS

A total of 20,000 house hold broiler birds of different age groups from different parts of Mizoram, India were examined. The birds were maintained in cage system made of bamboo and saw dust used as the litter. Clinical signs and management practices were observed. Out of 4000 birds only 40 birds of either sex were found positive at post mortem examination. No mortality was observed. Gross lesions were recorded. Small pieces of liver from the affected part put in 10%
formalin saline and subsequently processed for histopathological studies. Haematoxylin and Eosin was used for staining tissue as per standard staining technique. The stained slides were examined under light microscope.

The PCR was done as per Huber et al. (2005). The PCR DNA was extracted from approximately 250 mg of liver tissue with Hipura Tm mammalian genomic DNA miniprep purification spin kit (HIMEDIA). The tissue were thawed and 250 mg pieces removed mashed up using scissor, vortexed and then incubated overnight in an water bath with protease K. The tissues were further processed according to the manufacturer’s protocol and from the sample 10 µl of eluted DNA were used for PCR amplification.

**DNA amplification:** Reaction mixture (50µl) for each sample contained 10 mM Tris-HCl (pH 8.3), 50 mM KCl, 2mM MgCl₂, 200µm of each deoxyribonucleotide, 100p mol of each oligonucleotide primer and target DNA. The forward primer for histomonas meleagridis was designated as HIS 5FC(5- CCTTTAGATGCTCTGG GCTG-3) and the reverse primer was HIS 5R (5- CAGGACGTATTCAACGTG-3) as per Huber et al. (2005). The PCR was done in Master cycler Gradient Machine (Eppendorf, Germany).

**RESULTS**

The affected birds showed inappetence, ruffled feathers, and slight yellowish appearance of combs and wattles. The droppings of positive cases were watery and yellowish in colour with streaks of white mucus. Gross liver lesions included yellowish circumscribed depressed necrotic areas with raised border with a diameter of 2 mm to 1 cm (Fig. 1). Caecal walls were severely thickened, the lumens were distended with caseous cores and the mucosa were ulcerated. Heterakis gallinarum was found in caeca of positive birds (Fig. 2).

Microscopically varying amounts of histomonas trophozoites were detected in liver (Fig. 3). Mononuclear cellular infiltration often containing giant cells, necrosis of hepatocytes and infiltration of macrophages were the predominant microscopic lesions in the liver. There were multifocal necrosis and granulomatous inflammation in the caeca. The PCR selectively amplified 209 bp of the small subunit ribosomal DNA sequence of Histomonas meleagridis (Fig. 4). The percent prevalence of histomoniasis in different parts of Mizoram, India is presented in Table 1.

**DISCUSSION**

No birds were found dead due to histomoniasis during investigation but caecal and hepatic lesions were observed. Histomoniasis is essentially a disease of turkeys but chicken are also occasionally found to be infected (Kaufmann, 1996). Histomoniasis is detected and described in naturally affected 400 broiler birds (Table 1). The highest incidence of infection is recorded from Aizawl District of Mizoram (3%). *Heterakis gallinarum* was recovered at post mortem examination from all the infected birds from this area suggesting vector potentiality of the caecal worm for this protozoan. This is the first report of naturally occurring systemic histomoniasis in broiler birds from Mizoram, India. The presence of histomoniasis was linked to cleanliness of the building, wet litter and diarrhoea. In the present study *Heterakis gallinarum* was recovered from the caeca of the affected birds during post mortem examination. *Heterakis gallinarum* is a common nematode parasite of the domestic chicken and turkey. The main route of histomonas infection is by ingestion of the embryonated eggs of the caecal worm *Heterakis gallinarum*. 
As invading histomonads go deeper through the caecal mucosa, they take the hepatoportal route and are carried to the liver, where they cause multi focal necrosis (Bon Durant and Wakenell, 1994). A similar observation was also noticed in the liver of affected broiler chicken in the present study.

Histopathological studies have shown that many individual and clustered histomonads are visible in lacunae near the periphery of lesions confirming the results of McDougald, 1997.

By PCR the parasite DNA was only detected in liver lesions but never in healthy parenchyma. It was also shown that PCR based detection was a more sensitive technique than detection based on histopathological examination. However, the sensitivity of PCR can be increased by adding the nested PCR. Since little molecular data are available on *H. meleagris*, this preliminary study represents a foundation for further molecular studies on this parasite.

**REFERENCES**


