

Paper

Increase of *Clostridium perfringens* in association with *Eimeria* in haemorrhagic enteritis in Japanese beef cattle

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A coprological survey with detailed clinical observation of naturally occurring haemorrhagic enteritis (HE) cases was conducted to understand the pathophysiology of HE by clarifying the infection status of *Eimeria* and enteropathogenic bacteria in cattle. Faecal samples from 55 cases of HE and 26 clinically normal animals were collected, and a quantitative examination of *Eimeria* and potential enteropathogenic bacteria was performed. The number of *Eimeria* species oocysts per gram of faeces (OPG) exceeded 10,000 in 69.1 per cent of HE cases with a maximum of 1,452,500 OPG and *Eimeria zuernii* was found to be overwhelmingly dominant. A significant increase in faecal coliform count was observed in HE cases compared with clinically normal animals. Among the animals shedding >10,000 OPG, 42.9 per cent showed a remarkable increase in *Clostridium perfringens* abundance (>10⁴ CFU/g) in the faeces. In the cases with *C. perfringens* detected, its abundance was positively correlated with *Eimeria* OPG and high *C. perfringens* abundance was always accompanied by high *Eimeria* OPG. *E. zuernii* is likely to play a crucial role in massive multiplication of *C. perfringens* in HE in cattle.

Bovine coccidiosis, often caused by *Eimeria bovis* and *Eimeria zuernii* infections, is regarded as one of the most important diarrhoeal diseases in cattle, causing moderate diarrhoea to severe life-threatening haemorrhagic enteritis (HE) (Friend and Stockdale 1980, Stockdale and others 1981). These protozoa are found worldwide, and the vast majority of cattle are exposed to them at some time in their lives. Calves between three weeks and six months old are particularly susceptible to the infection, resulting in clinical coccidiosis (Oda and Nishida 1990, Taylor and Catchpole 1994, Dausgchies and Najdrowski 2005,

Matsubayashi and others 2009). This has led to a number of reports and studies describing the clinical significance and treatments for the disease in calves (Stockdale and others 1981, Bangoura and others 2007, Jonsson and others 2011). Cases of severe coccidiosis with bloody diarrhoea in mature animals have also often been observed in fattening farms, especially in Japanese Black (full-blood Wagyu) as reported by various Prefectural Federation of Agricultural Relief Associations and Prefectural Livestock Hygiene Centres in Japan. Unfortunately, few documents concerning the aetiology have been published internationally (Sato and others 2010). For these cases, conventional treatment methods blindly relying on the use of anticoccidial drugs often did not produce satisfactory results. Further investigation of the aetiological characterisation of the disease in fattening cattle, potentially also taking into consideration the effect of co-infection with other pathogens, is required (Kano and others 2011).

It has been demonstrated in pigs (Mengel and others 2012) and chickens (Collier and others 2008) that coccidial infections can lead to severe enteritis associated with *Clostridium perfringens*. However, such studies are virtually lacking for bovine coccidiosis even though it is conceivable that *Eimeria* infection in cattle may also play a crucial role in the colonisation and/or proliferation of other pathogens such as enteropathogenic bacteria. This study explores the infection status of *Eimeria* and potential enteropathogenic bacteria in HE cases observed in Japanese beef cattle including calves and fattening cattle to understand the pathophysiology of this disease.

Materials and methods

Sample collection

The samples were collected between April and July 2012 from commercial farms in Kyushu (southern island of Japan, nine farms) and Tohoku (northeast region of the main island of

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ABSTRACT

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