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Biochemical observations in native goats naturally infected with bluetongue

Y P S MALIK[1], V THAKRE[2], M KADAM[3] and N K JAIN[4]

Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur, Madhya Pradesh 482001 India

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Bluetongue (BT) is one of the economically important diseases because of its morbidity, mortality and international trade restriction on animals, animal products and germplasm (OIE 2009). Biochemistry panels are used to help identify tissue injury (Bray *et al.* 2001, Chandra *et al*. 2002). Viral infections elicit several changes in the host metabolic system, vis-à-vis severity of viremia and with tissue or organ damage (Kubo *et al*. 2001, Bray *et al*. 2001, Chandra *et al*. 2002). Recently, blood cellular damage (Singh *et al*. 2008) and histopathological changes in liver, kidney, spleen and other related organs were found in sheep experimentally infected with bluetongue virus (BTV) 23. Similarly, Flanagan *et al.* (2008) reported altered biochemical response in sheep infected with a different serotype 8 of BT virus. Few other reports are available from experimentally infected sheep (Jeggo *et al*. 1986, Mahrt and Osburn 1986). However, information is scanty on biochemical alterations due to BT infection, particularly during natural infections in goats. These observations made it necessary to investigate the various serum biochemical parameters associated with cellular and organ damage in native goats infected with Bluetongue virus (BTV).

Study was performed on animals which were confirmed to be infected and uninfected by detecting levels of antibodies to BTV using competitive ELISA. Blood from several native goats of Madhya Pradesh (pyretic and healthy non-pyretic) were collected and grouped into groups 1 and 2, with high levels of antibodies and absence of antibodies, based on per cent inhibition in cELISA. For serum biochemistry, about 5 ml of blood was collected aseptically from native goats and processed for separation of serum by keeping undisturbed at room temperature. Serum was harvested from clotted blood within 1 h by centrifugation (5000 rpm/10 min), and immediately stored at –20°C prior to analysis. Serum samples were examined for biochemical alteration for aspartate aminotransferase (AST), alanine aminotransferase (ALT), □-glutamyltransferase (GGT), blood urea nitrogen **(**BUN), alkaline phosphatase (ALP) and serum creatinine in the clinical auto analyzer using standard kits and compared with control group 2. Mean and standard error of the results were computed for each group. Statistical analysis was done using student t-test and values of $P<0.05$ were considered significant.

Significant changes in biochemical measurements, namely ALT, AST, ALP and GGT were observed in the naturally infected animals (Table 1). The ALT values were significantly higher in group 1 than group 2 ($P\leq0.05$). The AST value of group 1 was significantly higher ($P\leq0.05$) than group 2. The serum ALP values of group1 were significantly higher than group 2. The GGT values for group 1 were significantly higher than group 2. The CK values of group I were significantly higher than group 2. However, the BUN values of group 1 were not significant from group 2.

Table 1. Sero-biochemical profile (mean±SE) of naturally infected native goats with bluetongue

Groups	Alanine amino transferase	Aspartate amino transferase	Serum creatinine	Alkaline phosphatase	c-Glutamyl transferase	Blood urea nitrogen
1	$56.37^{a\pm}5.51$	$442^{a}\pm29.36$	$3.82^{a}\pm0.39$	$113.34^{a}\pm6.62$	$76.12^{a}\pm4.45$	$38.90^{a}\pm4.45$
2	$24.36^{c\pm}5.51$	$257^{d}\pm29.36$	$2.51^{b}\pm0.39$	$92.41^{b}\pm6.62$	$41.97^{d}\pm4.45$	$34.20^{a}\pm4.45$

*Values with different superscripts indicating significant differences.

Serum enzyme concentrations are altered by infectious as well non-infectious factors. The levels of any single enzyme in serum, indirectly reflects its concentration in the

Present address: [1]Senior Scientist, Division of Virology, IVRI Mukteswar Campus, Nainital, Uttarakhand (e mail: malikyps @yahoo.com).

[2]M.V.Sc. scholar, Department of Veterinary Microbiology; [3]Scientist, Molecular Diagnosis and Therapeutics Laboratory, Biotechnology Centre; [4]Professor, Department of Veterinary Pathology.

cell, the total tissue mass, extent of cell injury, normal cell death, apoptosis, and its degradation in plasma (Kaneko *et al*. 1997). In the present study levels of ALT, AST, ALP and GGT were significantly higher in the group I than group 2. Similar activity of some enzymes, viz. ALT, AST, ALP, CK in experimentally BT infected sheep was recorded by Singh *et al.* (2008). Flanagan *et al*. (Copyright 1993 *The Journal of the Australian Veterinary Association* 2008) also reported significant changes in plasma enzyme concentrations of AST and CK in the infected sheep. Jeggo *et al.* (1983) also suggested higher values of CK and AST in BT infected sheep. Though elevated CK values were recorded in BT infected sheep in past, in the present study CK values were not significantly high in group1 than group 2. Similar findings were shown by Jeggo *et al*. (1986) in which they reported the increase in CK was not to the extent and correlated this enzyme level with the virulence of virus. CK is reported to be present in many cell types but its highest activity seen in skeletal muscles. Skeletal muscle degeneration and necrosis are related to increased activity of CK in BTV infection (Mahrt and Osburn 1986, Jeggo *et al.* 1986, Singh *et al.* 2008). The muscle damage was further supported by increased level of AST. Though these all reports are from sheep in which all clinical signs establish more than other species. Thus, it is possible that goats may not show all values which are observed in sheep.

High levels of ALT and AST are also indicative of hepatocellular changes. Their higher levels are also reported to be associated with muscle damage (Valentine *et al*. 1990). In present study, high levels of ALT observed in the group1 animals, indicative of liver damage. The values of ALT were towards normal in group 2. AST is considered a reliable marker for soft tissue damage as it is present in various tissues like liver, heart, skeletal muscle, kidneys, brain, pancreas, lungs as well as in white and red blood cells (Boyd 1983). In the present study, the high level of AST in group 1 than group 2 are indicative of damage to soft tissues like lymphoid organs (spleen and lymph nodes), kidney, liver, lungs and striated muscles. These findings are in agreement with the earlier reports (Jeggo *et al*.1986, Singh *et al.* 2008, Flanagan *et al*. 2008 (Copyright 1993 *The Journal of the Australian Veterinary Association*). Though ALP is known to be present in all tissues, the greater activity of this enzyme is seen in kidney, liver and intestinal tissues (Stigbrand *et al.* 1984). Singh *et al.* (2008) found lesions in kidney and liver, which might have been contributed to the high level of this enzyme in the serum. During the present study values of ALP were significantly higher in group 1 than group 2, indicating damage of kidney and liver tissues.

GGT is found in many tissues but liver is the primary source. GGT is associated with glutathione metabolism. The increased serum GGT with hepatic disease was reported by Kaneko *et al*. (1997). In present study, serum GGT values were significantly higher in group 1 animals than group 2, clearly indicating the liver damage in BT infection of goats. The other biochemical parameter, BUN, is used to evaluate the ability of the kidneys to remove nitrogenous waste from the blood. Increased level of BUN is seen in pre-renal causes like shock, congestive heart failure, dehydration causing damage to 75% nephrons and post renal causes like obstruction in the urinary passage. In the present study, BUN level was not significantly higher in group 1 than group 2, indicative of no damage to the kidney in BTV infection in goats. It seems, therefore, that the infection of goats with BT caused cellular and tissue damage, as indicated by the changes in biochemical parameters. The biochemical alterations observed in naturally BT infected goats are similar to naturally or experimentally infected sheep except for BUN where values were unchanged in naturally infected goats to control groups indicating least damage to kidney.

SUMMARY

The study was made to investigate the various serum biochemical parameters associated with cellular and organ damage in native goats infected with BTV. Study was performed on animals which were confirmed to be infected and uninfected by detecting levels of antibodies to BTV using competitive ELISA. Serum samples were examined for biochemical alteration for aspartate aminotransferase (AST), alanine aminotransferase (ALT), □-glutamyltransferase (GGT), blood urea nitrogen **(**BUN), alkaline phosphatase (ALP) and serum creatinine in the clinical auto analyzer using standard kits and compared with control group 2. Significant changes in biochemical measurements, namely ALT, AST, ALP and GGT were observed in the naturally infected animals. High levels of ALT and AST are also indicative of hepatocellular changes. infection of goats with BT caused cellular and tissue damage, as indicated by the changes in biochemical parameters. The biochemical alterations observed in naturally BT infected goats are similar to naturally or experimentally infected sheep except for BUN where values were unchanged in naturally infected goats to control groups indicating least damage to kidney.

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REFERENCES

Boyd J W. 1983. The mechanisms relating to increase in plasma enzymes and isoenzymes in diseases of animals. *Veterinary Clinical Pathology* **12**: 9–24

Bray M, Hatfill S, Hensley L and Huggins J W. 2001.

Haematological, biochemical and coagulation changes in mice, guinea-pigs and monkeys infected with a mouse-adapted variant of Ebola Zaire virus. *Journal of Comparative Pathology* **125**(4): 243–53.

Chandra R, Kapoor D, Agarwal S R, Malhotra V, Sakhuja P and Sarin S K. 2002. Profile of asymptomatic chronic HBV infection in India. *Indian Journal of Medical Research* **116**: 50–7.

Flanagan M, Johnson S J, Hoffmann D, Polkinghorne I G, Reid D J and Shepherd M A. 2008. Clinical pathology of Australian bluetongue virus serotype 16 infection in Merino sheep. *Australian Veterinary Journal* **70** (3): 101–04.

Jeggo M H, Gumm I D and Taylor W P. 1983. Clinical and serological response of sheep to serial challenge with different bluetongue virus types. *Research in Veterinary Science* **34** (2): 205–11.

Jeggo M H, Gumm I D, Taylor W P, Davidson W H and Gorman B M. 1986. Virulence of bluetongue virus for British sheep. *Research in Veterinary Science* **42**: 24–28.

Kaneko J J, Harvey J W and Bruss L M. 1997. *Clinical Biochemistry of Domestic Animals*. 5th edn. pp. 303–25. Academic press, London.

Kubo S, Hirohashi K, Tanaka H, Tsukamoto T, Shuto T, Higaki I, Takemura S, Yamamoto T, Nishiguchi S and Kinoshita H. 2001. Virologic and biochemical changes and prognosis after liver resection for hepatitis B virus-related hepatocellular carcinoma. *Diagnostic Surgery* **18** (1): 26–33.

Mahrt C R and Osburn B I. 1986. Experimental bluetongue virus infection of sheep; effect of vaccination; pathologic, immunofluorescent, and ultrastructural studies. *American Journal of Veterinary Research* **47**: 1198–1203.

O I E Terrestrial Manual. 2009. *Bluetongue*. Chap. 2.1.3, pp. 158–74.

Singh K P, Channakeshava S U, Ahmed K A and Pandey A B. 2008. Haematological and biochemical responses in native sheep experimentally infected with bluetongue virus serotype 23. *Indian Journal of Animal Sciences* **78** (1): 8–12.

Stigbrand T, Millan J L, and Fishman W H. 1984. *Human Alkaline Phosphatase*. Pp.34. Allen R. Liss, New York.

Valentine B A, Blue J T, Shelley S M and Cooper B J. 1990. Increased serum alanine aminotransferase activity associated with muscle necrosis in the dog. *Journal Veterinary Internal Medicine* **4**: 140.