Pestivirus infections in kids of wild goats (*Capra hircus aegagrus*)

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**ABSTRACT**

Five stray wild goat kids (1.5-6 months old) found in forestland by Antalya Directorate of Nature Conservation and National Parks within different periods were brought to Antalya Zoo for feeding and care. The kids were dead after a short time of their arrival to the zoo. The dead animals were examined within the same day of their arrival to the lab. During the viral examination, presence of pestivirus antigen (Ag) was detected in blood samples, brain and liver of months old kid, brain and spleen of two animals viz. six months and two months old. All tissue samples were also studied for Bluetongue virus (BTV) Ag by Fluorescent Antibody Test (FAT) but the samples were found to be negative. While two animals of six and two months old showed Pestivirus infection according to their clinical symptoms, virological and pathological results.

**Key words:** Antigen ELISA, Bluetongue virus, Pestivirus, Wild goat.

**INTRODUCTION**

Pestiviruses have been detected in more than 50 species of wild animals living free in natural life in various parts of the world (Campen *et al.* 2001; Arnal *et al.* 2004; Vlcek and Nettleton, 2006; EAZA, 2014; Ridpath, 2015). Infection during the first trimester can produce calves that remain persistently viraemic for life (Brownlie, 1990). Persistent animals also show such immunotolerance against infectious virus strain that although they look healthy, the animals might infect other animals spreading the virus with all their secretions and excretions (Lindberg and Houe, 2005). Even if the reservoir state of pestiviruses in wild animals is not completely clear, studies carried out in this direction have drawn attention recently (Casaubon *et al.* 2012).

Bluetongue virus (BTV) infection is important viral disease transmitted by stinger flies and cause serious economic losses especially in small ruminants (Murphy *et al.* 1999; Roy, 2010). Infectious particle of BTV firstly carries out its replication first in placenta, then spreads onto spleen, liver, other tissues and organs. During the last stage of the infection, the virus runs in blood and might stay here also (Roy, 2010). During 28-56 days of pregnancy in small ruminants, Akabane virus (AKAV) carries out its replication first in placenta, then in trophoblastic cells and finally in fetus itself and causes congenital defects, arthrogryposis (AG) hydrancephaly (HE) and abortions (Murphy *et al.* 1999; Mellor and Kirkland, 2008). Even though the host spectrum hasn’t revealed completely, Peste des Petits Ruminants virus (PPRV), known to have caused acute, high mortality and contagious diseases in pure sheep and goat populations, doesn’t provide sufficient information about its pathogenesis for wildlife and zoo animals (Murphy *et al.* 1999; Barrett, 2008). Specific antibodies against BTV and AKAV have been detected in many animals living in wildlife (such as horses, pigs, deer, antelopes, hippos, giraffes etc.), and wide wildlife host spectrum is suspected for PPRV (Barrett, 2008).

In this study, after the death of wild mountain goat kids found alone in wild and taken to Antalya Zoo to be cared, presence of Pestivirus and BTV was studied.

**MATERIALS AND METHODS**

Clinical and/or necropsy samples: Five strayed mountain goat kids as one six-months-old female (No:1), one 1.5-months-old male (No:2), one 1.5-months-old female (No:3), one two-months-old female (No:4) and one two-months-old female (No:5) found in forestland by Antalya Directorate of Nature Conservation and National Parks within different periods were taken to Antalya Zoo for feeding and care. All these animals died in 1-2 days due to diarrhea, weakness and anorexia. The dead animals were presented to pathology and virology labs of our faculty with cold chain within the same day. The animals were sent in the spring of 2015.

Blood was collected from the hearts of kids having died in pathology necropsy hall. Serum and leucocytes were then separated from the blood samples. Samples of brain, liver, spleen and lung from all animals were collected into sterile plastic containers by using different sterile clippers and bistoury for each animal.

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Necropsy was performed for all five animals. Tissue samples were collected and fixed in 10% buffered formalin for histopathological examination. Then tissue samples were routinely processed and blocked in paraffin. Five micron was sectioned by a Leica 2155 rotary microtome and stained with hematoxyline-eosin (HE) and examined under the light microscope (OIE Manuel of Diagnostic Tests and Vaccines for Terrestrial Animals 2012).

**Antigen ELISA for Pestiviruses:** Bovine Viral Diarrhea Virus (BVDV) ELISA (IDEXX, USA) kit was used to detect pestivirus antigen (Ag) presence in leucocyte samples of all animals.

**Fluorescent antibody tests (FAT) for Pestiviruses and BTV:** Cross sections of tissue samples (brain, liver, spleen, lung) were palpated separately onto each preparate for the study. Having been dried for at least 30 minutes in room temperature, the preparates were fixed in acetone for at least 15 minutes again in room temperature. After evaporating the acetone on preparations completely, specific 50-75 µl Anti-FITC-Ig (anti-fluorescein isothiocyanate-immunglobulin) conjugate was performed on preparates for each factor. Having been left for incubation for 30 minutes at 37 °C, the preparates were then kept in Rinse Buffer, pH 9.0 (VMRD catalog no 210-90-RB). After drying completely, one single drop of 90% glycerin 10% PBS (pH 7.4) mixture was dropped onto preparates and the area to be scanned by the help of dropper and this area was closed with a coverglass. All preparates were studied under fluorescent microscope.

**RESULTS AND DISCUSSION**

At the end of the virological test performed for leucocyte samples, pestivirus Ag (+) for sample No:1 and 4, and Ag(-) for others was detected (Table 1).

At the end of FAT performed for tissue samples, pestivirus Ag (+) in brain and liver tissues and pestivirus Ag (-) in spleen and lung tissues for sample No:1 was found. In all tissues of this sample, BTV Ag (-) was found (Table 1). Pestivirus Ag (+) in brain and spleen tissues and pestivirus Ag (-) in liver and lung tissues for sample No:4 was detected. In all tissues of this sample, BTV Ag (-) was found (Table 1).

At necropsy, slight hyperemia was observed in mesenterial vessels in all animals. In two kids (No:2 and No:3) approximately 20-30 ml serous, pink color fluid was seen in abdominal cavity. Watery content was observed in the lumen of the intestine. Marked hyperemia and slight hemorrhagic foci was noticed in meninges in two animals (No:1 and No:4). There was no congenital abnormality in any organ.

At the histopathological examination, the most common lesions were localized in brains. In addition to meningeal hyperemia, edema, hemorrhages and slight lymphocyte infiltrations were observed around the vessel of brains in two kids (No:1 and No:4) (Figure 1). Hyperemia

**Table 1:** The results of Ag ELISA and FAT

<table>
<thead>
<tr>
<th>Samples</th>
<th>ELISA (Pestivirus-Ag)</th>
<th>FAT (Pestivirus-Ag / BTV-Ag)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Brain</td>
<td>Liver</td>
</tr>
<tr>
<td>No:1</td>
<td>+</td>
<td>+ / -</td>
</tr>
<tr>
<td>No:2</td>
<td>-</td>
<td>None</td>
</tr>
<tr>
<td>No:3</td>
<td>-</td>
<td>None</td>
</tr>
<tr>
<td>No:4</td>
<td>+</td>
<td>+ / -</td>
</tr>
<tr>
<td>No:5</td>
<td>-</td>
<td>None</td>
</tr>
</tbody>
</table>

**Fig 1:** Histopathology of brains of kids that died from pestivirus infection (A) Slight perivascular lymphocyte infiltration (arrows), (B) Slight perivascular infiltration (arrows) and hemorrhage (arrow heads), HE, Bars=100µm.
and degenerations, slight lymphocyte infiltrations and Kupffer cell proliferations were observed in one kid’s liver (No:1). In all kids, increase in septal wall thickness and slight inflammation was found in lungs (Figure 2). Desquamation and slight infiltration was noticed at the intestinal propria mucosa. There were no pathological findings in other organs except hyperemia.

The permanent changes that humans make on earth in line with socioeconomic, together with animal domestication, global warming and natural events might trigger the interactions (describe the kind of possible interactions) between wild and domestic animal species. Even though these interaction mechanisms couldn’t be clarified completely in terms of viral infections, in some studies, these kinds of interactions were reported to have played an important role on the pathogenesis of infections (Bengis et al. 2002).

In a study performed by Pastoret et al. (1988) on pestivirus infections in wild ruminants, they reported that there was no connection of the pestivirus infection between wild animals and domestic ruminants. After that, Meyling et al. (1990) stated that the main resource of pestivirus infections in domestic ruminants is wild animals. Hence, Becher et al. (1997) determined that pestiviruses have a fairly common host spectrum in biungulates (Artiodactyla) which they could infect passing through the barrier between species and that especially BVDV and BVDV could infect many domestic and wild ruminants (Becher et al. 1997; Becher et al. 2003). Mishra et al. (2007) reported the presence of pestivirus in Native Indian goats (Capra hircus) and even isolated BVDV type 2 strain.

Over the past years in our country BTV infection presence was detected in Western Anatolia region and was brought under control by a successful vaccination programme (Yonguc et al. 1982). Besides, during a serological study performed in Black Sea region, antibody (Ab) presence in domestic ruminants was found (Albayrak and Ozan, 2010). The fact that wild ruminants also were in the host spectrum of BTV is one of the realities of this study. BTV antibody positive results determined in this study (No:1-5 blood samples) points to the presence of BTV infection in wildlife. However, whether there is a connection between BTV infections found in domesticated goats and wild mountain goats still isn’t known corporally yet.

Domestication of Capra hircus aegagrus, known as the ancestor of domestic goats around the world, for the first time in Turkey, Northern Syria, Mount Zagros, Iran and Iraq regions in 10000 BC (Zeder and Hesse, 2000) shows that the infections lately detected in these regions might in fact date back to earlier years. Accordingly, viral infections showing similar symptoms and each condition and environment (mutual grazing lands, vectors etc.) where wild and domestic goats could contact each other would play an important role in interrelated infection. Together with the obtained results, the fact that the clinical symptoms found in free-range mountain goats in their late stages and the pathological findings from internal organ samples of necropsy animals showed a similarity with the table of infection that viral diseases caused in domestic cattle, sheep and goats was such as to support Pestivirus (Ag) and BTV (Ag) findings detected in this study.

At the end of this study, we realize that we need to struggle in wildlife also in order to prevent Pestivirus and BTV infections. For this purpose, we need to isolate water and grazing areas of domestic sheep-goat populations and establish buffer zones to prevent domestic animal populations from infections through possible contact routes. Besides, for these diseases, we suggest to establish combat programmes in wildlife similar to the one for rabies.

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![Fig 2 (A): Slight lymphocyte infiltration (arrows) and increase in Kupffer cels (arrow heads) in a liver a kid died from pestivirus infection, (B) Hyperemia, increase in septal wall thickness (arrow heads) and slight mononuclear cell (arrows) infiltrations in lungs, HE, Bars=100µm.](image-url)
REFERENCES


