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Review Article

An Overview of Treatment Options to Combat Peste des Petits Ruminants in Endemic Situations

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ABSTRACT

Peste Des Petits Ruminants (PPR) is a disease of sheep, goat and can affect wild animals, caused by the morbillivirus. It mainly affects the respiratory system and gastrointestinal tract. Clinical signs of PPR are the stomatitis, pyrexia, occulo-nasal discharges along with diarrhea and ulcerative lesions. Although there is experimental work on efficacy of antiviral treatment yet in the field symptomatic treatment and vaccination are the options. Antiviral therapy mainly affects the virus replication and also has the inhibitory effects on the gene silencing for RNA interference. Herbal medicines are also used for treatment such as ethno-veterinary herbal medicine and goat weeds. Goat weed has different actions such as antipyretic, for dressing, laxative and purgative while fruit extracts such as lemon are effective against orf like labial scabs. Antiviral therapy is mainly on experimental basis while herbal medicines are widely used as field treatment. Use of hyper-immune serum, supportive and symptomatic treatment is also used but success rates vary depending on the disease severity and time of treatment.

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INTRODUCTION

Small ruminants having the significant role in poverty decline. Many groups and programs, for poverty decline and replacing are giving out goats to internally moved persons (IDPs), going back to their villages (Sande et al., 2011). Peste des petits ruminants (PPR) is a severe, transmissible and mortal disease of sheep and goats. It is also called as goat plague and kata (Annatte et al., 2006). PPR virus expresses a haemagglutinin (H) glycoprotein on as its outer envelope that is crucial for viral attachment to host cells and represents a key antigen for inducing the host immune response (Qin et al., 2012). PPR not only affects the small ruminants but also has detrimental effect on the wild life like ibex and gazelle (Sharawi et al., 2010; Abubakar et al., 2011). PPR virus has also close relation with the Measles virus and Canine distemper virus and many part of the world disease is endemic including Africa, Asia and Middle East (Jalees et al., 2013 ; Forsyth et al., 1995).

Clinical signs of PPR disease are erosive stomatitis, diarrhea, pyrexia, ocular and nasal discharges. Sheep suffer less clinical disease (El Hag and Taylor, 1988; Roeder et al., 1994) although high morbidity and mortality has been reported but it is assumed that sheep may hold some innate resistance to clinical disease (Shaila et al., 1989). Abubakar et al. (2008) has reported that PPR has a possible association with mortality and occurrence of high rate of abortions in goats. There are also reports of high morbidity and mortality rates in both sheep and goats due to PPR (Abubakar et al., 2011; Dhar et al., 2002); Lefevre and Diallo, 1990) and in severe outbreaks, mortality can reach up to 100% (Radostits et al., 2000) but these rates may vary as mortality being low as 20% (Roeder and Obi, 1999; Abubakar et al., 2008). Das et al. (2007) reported the morbidity and mortality rate of 74% and 55% in PPR and these rates are higher in sucklers than in adult animals. Due to high temperature, erosive ulcerative lesions are formed (Kwiatek et al., 2007). Concurrent bacterial, viral or parasitic infections may aggravate condition and mortality up to 100% (Kitching, 1988).

PPR has the main impact on the economics of the country because it causes deaths in sheep and goats populations (Zahur et al., 2009). PPR virus causes the gastroenteritis along with mucous membrane ulcer and act as immunosuppressive agent in the body of small ruminants (Intizar et al., 2009). It also imposes a significant constraint upon sheep and goat production owing to its high economic losses (Asim et al., 2009; Abubakar and Munir, 2014).

PPR was first reported in Pakistan during 1994 when the confirmatory diagnosis was made by polymerase chain reaction (Amjad et al., 1996). This was further validated when the PPR virus (PPRV) antigen was detected during outbreaks at different area using immune-capture-ELISA (Hussain et al., 2002). Immunoperoxidase staining of formalin secure tissues for the diagnosis of PPR and to study virus discharge from giant cell and ileal epithelial cells formation in PPRV infected animals (Bundza et al., 1988).

Research is being carried out on the antiviral treatment strategies for newly exposed and much exposure of the PPR virus (Abubakar et al., 2011). Antiviral therapy has been applied both in vitro and in vivo experimentation (Goris et al., 2008; Sujatha et al., 2009; Abubakar et al., 2011). Ethno-veterinary herbs can also be used for the treatment of the PPR (Saliu et al., 2008). Goat weed is commonly used herb which is much effective for the treatment of the disease (Shekhar and Goyal, 2012).

The mutual sheep pox and PPR vaccine was organized in lyophilized form containing suggested doses of vaccine viruses. Safety and immunogenicity of this combined vaccine was assessed in sheep. Immunity in sheep subcutaneously can be developed with 1ml of live attenuated vaccine. Both component vaccines did not interfere with each other and can be used in target population for economic vaccination strategies (Chaudhary et al., 2009). Thermo-resistant Rinderpest vaccine that was developed to prevent PPR in Niger and it was cost effective (Chip Stem et al., 1993). Wosu et al. (1990) confirmed that tissue culture Rinderpest vaccine (TCRV) was very effective in protecting goats against the PPR disease, but that this efficacy only remianed if the vaccination is done when the animals are at a subclinical level of infection. Bivalent and/or trivalent vaccines should be developed to reduce the cost of vaccination for the protection against PPR virus as well as other important diseases of sheep and goats. This would improve poverty mitigation in areas where multiple viral pathogens of small ruminants exist (Diallo, 2006; Banyard et al., 2010).

Keeping in view the importance of PPR for small ruminants, the following review aims to portray the different antiviral and herbal treatment options for PPR. A summary of these treatment options is also given in table-1.

Antiviral treatment strategies

There are many strategies, used to protect from the viral diseases, but important one is the vaccination against that disease to immunize the individual well before exposure. Research showed that antiviral therapy can be used for control of PPR (Abubakar et al., 2011). Antiviral drugs are effective when virus newly exposed to the individual. It is important to check the efficacy, drug administration route and compound clearance from the body of the animals because those animals are the source of food and relevant bi-products for humans, e.g., milk, cheese and meat etc (Goris et al., 2008).

De-Almeida et al. (2007) studied about silencing of the gene expression by using RNA interference that is an antiviral strategy to control PPR. PPR virus replication can be inhibited by use of the RNA interference. siRNAs affecting the N gene of PPRV resulted in a less than 80% decline in virus *in vitro* replication. siRNAs NPPRV6 and NPPRV7, targeting two conserved regions of PPRV leading to clear inhibition of virus replication, reported as obvious drop in cytopathic effect, exposure of virus antigen by immunofluorescence staining, reduced viral titres and lessened quantities of viral RNA being detected.

In vivo therapy of RNAi requires the efficient delivery of siRNA molecules to the appropriate tissues. The *in vitro* antiviral action of 4, 4′ (arylmethylene) bis (3 – methyl – 1 – phenylpyrazol – 5 - ols) against PPRV has also been reported. The synthesized compounds having outstanding antiviral activity against PPRV and have more effectiveness than the standard ribavirin drug used (Sujatha et al., 2009; Abubakar et al., 2011).

Use of hyperimmune serum and fluid therapy

In the early stages of the disease valuable sick animals should be isolated and given hyper-immune serum. Extensive fluid therapy is required to cope up dehydration. Lesions around the nostrils, eyes and mouth should be cleaned along with providing good nursing (Radostits et al., 2007).

Use of symptomatic and supportive treatment

Wosu (1989) illustrated via an experiment that PPR cases treated symptomatically. Intestinal sedatives, broad spectrum antibiotics and fluid therapy is commonly used for the treatment of diarrhea, pneumonia and the restoration of the body fluid ionic balance along with good feeding and hygienic conditions. The survival rate of goats by this treatment was raised to 13.3%. Supportive treatment includes broad spectrum antibiotics to prevent secondary bacterial infections.

Herbal treatment options

Ethno-veterinary herbs are used for the treatment of PPR and these might be used in that case when alone PPR vaccine not work. Ethno-veterinary products are more readily available to farmers and easily administered to the animal than PPR vaccine. When ethno-veterinary and herbal medicine use in combination of the PPR vaccine then more effective and good result appear (Saliu et al., 2008). Extracts and metabolites from *Ageratum conyzoidesLinn (Goat weed)* have pharmacological and insecticidal actions. It is used as febrifuge, against colic, a purgative, as an anti-enteralgic skin ulcers, and antipyretic, for cuts as a wound dressing. The crude extract of goat weed causes the inhibition of nuero-muscular activity, wound healing effect and has analgesic effects. Goat weed extracts in the ethanol having *Spasmolytic effect and gastro protection by restraining* ulcer stress model. Goat weed in the oil form has analgesic, antipyretic and anti-inflammatory effects. Goat weed metabolites have the antidepressant effects and analgesic effects. Simple chromenes and chromans especially the 6-amino and 6-acetamido derivatives have been reported to have anti-depressant, analgesic and antipyretic properties (Shekhar and Goyal, 2012). Wosu et al. (1989) proved that Lemon fruit and Citrus aurantium are effective for the treatment of the orf-like labial scabs and increase the chances of recovery from PPR. Mason et al. (1992) reported that oral immunization with transgenic plants expressing vaccine antigens has been shown to produce specific immune responses. It is more convenient way of immunization and it offers more effective protection against pathogens interacting with host mucosal surfaces (Prasad et al., 2004; Streatfield et al., 2005).

Table-1: Summary of different products (Drugs/Herbal medicines) used for the treatment of PPR

Product	Advantage/ Effect	Reference
siRNAs	Affecting the N gene of PPRV and RPV; result in a less than 80% decline in virus replication	De-Almeida et al. (2007)
4, 4′ (arylmethylene) bis (3-methyl -1 –phenylpyrazol – 5 - ols)	Outstanding antiviral activity against PPRV	Sujatha et al., (2009)
Extracts and metabolites from *Ageratum conyzoides Linn* (Goat weed)	Insecticidal, antidepressant, analgesic, used as febrifuge, against colic. A purgative and as an anti-enteralgic skin ulcers, for cuts as a wound dressing.	Shekhar and Goyal, (2012)
Crude extract of goat weed	Inhibition of nuero-muscular activity, wound healing and analgesic	Shekhar and Goyal, (2012)
Goat weed extracts in the ethanol	Spasmolytic and gastro protection	Shekhar and Goyal, (2012)
Goat weed in the oil form	Analgesic, antipyretic and anti-inflammatory	Shekhar and Goyal, (2012)
Chromenes and chromans (6-amino and 6-acetamido derivatives)	Anti-depressant, analgesic and antipyretic	Shekhar and Goyal, (2012)
Lemon fruit and Citrus aurantium	Effective for the treatment of the orf-like labial scabs	Wosu et al., (1989)
Transgenic plants expressing vaccine antigens	Oral immunization; produce specific immune responses	Mason et al., (1992)
Oral immunization with transgenic plants expressing vaccine antigens	More convenient way of immunization	Prasad et al., (2004)
Oral immunization with transgenic plants expressing vaccine antigens	Effective protection against pathogens interacting with host mucosal surfaces	Streatfield et al., (2005)
Intestinal sedatives, broad spectrum antibiotics and fluid therapy	Symptomatic treatment for diarrhea, pneumonia and the restoration of the body fluid ionic balance	Wosu et al., (1989)
Hyper-immune serum	Early stages animal can be saved	Radostits et al., (2007)

CONCLUSIONS

PPR causes high economic loss in the small ruminant under endemic situations. We can use the antiviral and herbal products for the PPR treatment. In endemic situations, we can treat the animal with supportive therapy and herbal medicine but the use of ring vaccination can control the possible spread of the disease/ outbreak.

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