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Aluminium-magnesium silicate inhibits *parvovirus* and cures infected dogs

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ABSTRACT

Ability of a synthetic Aluminium-Magnesium Silicate [AMS] to inhibit activities of *canine parvovirus* [CPV] was investigated in vitro and in vivo. Five samples of CPV isolated in Nigeria, were each incubated with equal amount of a synthetic AMS on a volume to weight [v/w] basis, for one hour and then centrifuged. Viral titres of the supernatants were tested by the haemagglutination [HA] test and their mean titre compared with mean titre of portions of same viral samples, not incubated with the AMS. Also, five puppies and five adult dogs infected with the *parvovirus* isolates were treated by dosing each with 400 mg/kg of a drug formulation that has 12% AMS per *os* for seven days. As control, five puppies and five adult dogs from same class as the experimental dogs were similarly infected but were not treated. Incubating parvovirus with AMS reduced its load from mean HA titre 825.6 ± 261.1 to mean HA, 270.8 ± 132.1 [$p < 0.05$]. Also treating parvovirus infected dogs with a 12% AMS drug formulation reduced mortality due to the virus from 100% to zero [$p < 0.01$].

Keywords: Aluminium-Magnesium Silicate; Canine Parvovirus Haemagglutination Test

1. INTRODUCTION

Canine parvovirus disease is a contagious disease of dogs and wild canids. It affects all breeds of domestic dogs, foxes and wolves [1,2]. The disease was first recognized in the United States of America in 1978 [3]. It has since then been reported in many other countries including Nigeria [4].

Causative agent of *parvovirus* disease is a parvovirus [2,5]. The disease has been reported to be more severe in puppies than in adult dogs [6]. It is said to cause gastroenteritis in adults [7] but myocarditis in puppies [8]. It leads to high mortality among dogs [9]. Since emergence of CPV in early 1980s it has posed very serious problem to dog breeding, yet, there is no treatment for the disease [5]. Control of the disease is mainly by vaccination and by hygienic measures [10]. Recent reports show that even vaccination is no longer effective in controlling CPV disease due to constant mutation of the virus [11]. Carmichael [12] has therefore suggested that other ways to combat the disease be looked for.

Aluminium-Magnesium Silicate is an ore which occurs naturally as mineral deposits in India and in the United States of America [13,14]. Natural AMS, when purified, is used as medicine for both humans and for animals [15,16]. The EEC committee on veterinary medicinal products has declared it safe for use even on food animals [17]. Vanderbilt [13] also reported that AMS is used to bind drugs in making tablets which are used in treating humans and animals, because its molecules have both positively and negatively charged ends.

Since viruses also have electrical charges [18], if AMS is used as medicine, extracellular viruses may adsorb onto it and so fail to attach to host cells. This would disrupt the first stage of viral infection which is adsorption to the host cells' membranes. To get a pure form of AMS, devoid of the many impurities found in the natural AMS, aluminun silicate and magnesium silicate were reacted under a controlled ionic condition [19].

The synthetic AMS has been reported to reduce titre of Newcastle disease virus [NDV] in vitro and to reduce mortality of NDV infected chicks in vivo [20]. Haemmagglutination [HA] titre and sero-conversion abi- lity of Egg drop syndrome 76 virus also reduced following incubation with the synthetic AMS [21]. The synthetic AMS has also proved to have antiviral effects against *Infectious Bursal Disease virus* [22] and against *Peste des Petits Ruminants* virus [23].

It was therefore thought useful to test effect of the synthetic AMS on *canine parvovirus* both *in vitro* and *in vivo*.

2. MATERIALS AND METHODS

Five samples of CPV isolated in Nigeria (National Veterinary Research Institute, Vom, Nigeria) were used for the experiments. AMS used on the viral samples was synthesized by reacting aluminium silicate with magnesium silicate [19]. A portion of each of the 5 viral samples was mixed with equal amount of the AMS on a volume to weight (v/w) basis, and allowed to stand at room temperature for one hour before they were centrifuged at 3000 revolutions per minute for 10 minutes. The viral supernatants were then tested for CPV titres by HA test using 0.6% porcine RBC prepared as described by Wosu [24] as indicator, as control, intact portions of the 5 viral samples were similarly used for HA test on the same plates used for their supernatants. RBC controls were included in the protocol and the setup was incubated at 4°C [24]. Mean HA titre of supernatants of the viral samples incubated with AMS was compared with mean titre of their portions which were not incubated with the AMS before the HA test.

For the in vivo experiment, 20 dogs (10 puppies and 10 adults) were acclimatized for seven days during which they were treated with antibiotics (penicillin and streptomycin), vitamin B complex and Ivermectin to reduce bacterial and parasitic infections. Their rectal temperatures were also measured daily to ensure they were not incubating viral infections. Each of the dogs was then dosed with 2 ml of a CPV sample which had HA titre of 4096. They were observed daily for clinical signs of canine parvovirus disease including fever, anorexia, vomition and diarrhoea. At first sign of establishment of infection (fever), the experimental dogs were randomly divided into two groups each of 5 puppies and 5 adults. One group was treated by administering each dog with a drug containing 12% AMS in a base of dextrose monohydrate and aluminium silicate, at rate of 400 mg per kg body weight per os, for seven days. The second group served as untreated controls.

Mortality rates of the two groups were compared by chi-square. Also, gross pathologic and histopathologic lesions on the stomachs, intestines, lungs, hearts and livers of samples of the two groups were studied and compared to assess ability of the AMS drug to inhibit activities of the CPV in vivo.

3. RESULTS

Incubating samples of *Canine parvovirus* with the synthetic AMS reduced their viral loaf from a mean HA titre of 875.6 ± 261.7 to 270.8 ± 132.1 ($P < 0.05$). All the dogs treated with the AMS (adults and puppies) recovered while all the untreated controls died. Also, gross pathology of the untreated controls revealed swollen heart with rounded apex, pale - swollen lungs and congested liver in the puppies. The untreated adult dogs had discoloured and swollen intestines, congested and swollen liver and pale - swollen lungs on gross pathologic examination. Histopathologic examination revealed necrosis and cellular infiltration of the crypts of the duodenum, necrosis of hepatocytes, presence of pyknotic hepatocytes, dilation of the hepatic central veins and necrosis of the myocardial cells. There was no gross pathology in the treated cases sacrificed, except for pale lungs. Regenerating cells were also observed in the liver and duodenum of the treated samples at histopathologic level.

HA titres of samples of CPV incubated with the synthetic AMS are as shown on **Table 1**.

4. DISCUSSION

Incubating CPV samples with the AMS reduced their HA titres. This agrees with earlier results with *Newcastle Disease Virus* [20], *Egg drop syndrome 76 virus* [21], *Infectious Bursal Disease virus* [22] and with *Peste des Petits Ruminants Virus* [23]. Venkatachrisnan and Chenicoff [25] reported that Aluminium-Magnesium Silicate molecules posses both positive and negative electrically charged ends. Viral genomes also have electrical charges [18]. So the CPV particles may have adsorbed onto the AMS by electrostatic attraction and were removed in the in vitro experiment.

AMS is insoluble [26] and un-absorbable [13], yet results of the in vivo experiments suggest it was able to get to the heart, lungs and liver to inhibit pathologic activities of the CPV in those organs. It may have passed through the mucous membranes of the gastrointestinal tract due to the gastroenteritis caused by the viral infection [27]. Murray *et al*. [28] also reported that simple sugars carry charged molecules across intact mucous membranes by active transport. The AMS may also have been carried across even intact mucous membranes into the blood circulation by dextrose monohydrate molecules in the drug formulation.

Table 1. Haemagglutination titre of canine parvovirus vaccine samples incubated with AMS.

CPV samples	HA Titre	
	Incubated with AMS	Controls
1	2	32
2	8	512
3	68	512
4	256	1024
5	1024	2048
	270.8 ± 137.07	**825.6 ± 261.07**

Incubating CPV with the AMS reduced its viral titre [$P < 0.05$]

Suggestion that the AMS is able to reach blood circulation is supported by use of AMS as haemopurifier in women with menstrual pains [14].

This appears a successful use of AMS for treatment of a mammalian viral disease. Windholz [15] reported that AMS is safe when consumed by man and by animals. It has been in use for treatment of gastric ulcer for many years [16]. The two chemicals used to synthesize the pure AMS used in this study, aluminium silicate and magnesium silicate are also medicines approved for treatment of animals and man. So, results of these experiments appear to suggest that the synthetic Aluminium-Magnesium Silicate may be useful in treatment of viral diseases of animals and man.

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