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# Immune response to contagious bovine pleuropneumonia vaccine in dermatophilosis-infected animals

**R**éponse immunitaire à la vaccination contre la péripneumonie contagieuse bovine sur des animaux atteints de dermatophilose – Cinq zébus atteints de dermatophilose et 5 zébus apparemment sains ont été vaccinés contre la péripneumonie contagieuse bovine (PCB). Les anticorps humoraux de la péripneumonie contagieuse bovine et à *Dermatophilus congolensis* ont été mesurés à l'aide du test d'hémagglutination passive. Pour les 3 animaux les plus infectés, la réponse immunitaire à la PCB s'est avérée très faible, comparée à celle des 2 animaux moyennement atteints et à celle des témoins.

Les auteurs discutent brièvement de la signification de l'accroissement non spécifique du niveau sérique des anticorps à *D. congolensis* à la suite de la vaccination anti-péripneumonique.  
 Mots clés : Zébu – Réponse immunitaire – Péripneumonie contagieuse bovine – Dermatophilose – Vaccin – Nigeria.

## INTRODUCTION

Contagious bovine pleuropneumonia (CBPP) remains one of the major diseases of cattle in Nigeria. A mass vaccination campaign, (JP28), was launched in 1974 in order to control and eventually eradicate the disease from the country. After about ten years, the results are hardly impressive. Several factors militate against the success of the scheme. Among these was the deleterious effect of depressed immune response to CBPP vaccination as a result of trypanosomal infection of cattle as reported by ILEMOBADE *et al* (10). In a nomadic husbandry situation with very limited extension services, it is possible that other recurrent infections may inadvertently be undermining the success of the programme. In view of the wide prevalence of dermatophilosis, the aim of this experiment was to determine whether the expression of immune potential of such infected animals was impaired when vaccinated against CBPP.

## MATERIALS AND METHODS

### Experimental animals

A total of 10 Zebu cattle comprising of 5 dermatophilosis-infected cattle and 5 apparently normal ones were used. They were all from breeding herd of the Veterinary Research Institute, Vom, and were known not to have been vaccinated against CBPP. The animals were run with the rest of the herd until the worsening condition of some of the infected animals dictated the need to confine them to separate paddock. The animals were brought to the holding pen every morning for some concentrates to supplement their grazing. The animals were screened for CBPP antibodies using the passive haemagglutination test as described by CHIMA and ONOVIRAN (4) and were found to be negative. This experiment was carried out during the rainy season between July and October, 1983.

### CBPP vaccine

A batch of T<sub>1</sub> broth culture vaccine produced essentially as described by BROWN *et al* (2) was used. A dose consisted of 0.5 ml containing approximately  $1 \times 10^8$  colony forming units (CFU) of *Mycoplasma mycoides* subsp. *mycoides* given subcutaneously at the tip of tail.

### Experimental procedure

The animals were divided into 3 groups. Three of the animals that had multiple lesions of dermatophilosis on the back, perineal region and legs were classified as being fairly severe (Group A). The other 2 animals that had few lesions either on the back, perineal region and face were classified as mildly affected (Group B). The number of animals used was dictated by the available clinically infected animals at the beginning of the

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experiment. The remaining five animals that were apparently normal and without any visible lesion served as control (Group C).

All the 10 animals received 0.5 ml of the vaccine and were observed for any reaction. The animals were bled twice every week and sera obtained were stored at  $-20^{\circ}\text{C}$  until examined.

## Serology

The sera were assayed for antibody against CBPP using passive haemagglutination test as described by CHIMA and ONOVIRAN (4). Briefly, *Mycoplasma mycoides* subsp. *mycoides* antigen was centrifuged from broth cultures and adjusted to a protein concentration of 7 mg/ml in 0.01 M PBS of pH 7.0 for sensitizing glutaraldehyde-fixed sheep red blood cells (SRBC). Titrations were made in V well microtitre plates (Linbro Scientific Co. Hamden Connecticut) using a 2 p.100 suspension of the sensitized SRBC. The test was read after incubation for about two hours at room temperature.

*Dermatophilus congolensis* antibody titration was carried out using a slight modification of the passive haemagglutination test described by MAKINDE and MAJIYAGBE (14). Briefly, *D. congolensis* cytoplasmic antigen prepared from homogenized whole cell as described by HOLMBERG *et al.* (9) was used to sensitize glutaraldehyde-fixed SRBC as described by GODING (8). The assay was carried out with 1 p.100 suspension of the sensitized SRBC using the Cooke Microplate system.

## RESULTS

### Clinical observation following vaccination

There was no local reaction following vaccination as was evidenced by lack of swelling at the site of vaccination and no febrile response. However, the dermatophilosis lesions of 3 infected animals (Group A), that were fairly severe at the commencement of the experiment became more severe with time. Two of the animals became recumbent and died of pneumonia at the 6th and 8th week post-vaccination respectively. The first animal died of verminous pneumonia caused by *Dictyocaulus viviparus*. *Pasteurella multocida* was

isolated from the lung of the second animal. The third animal was killed *in extremis* at the 11th week post-vaccination showing hypostatic congestion of the lung. On the other hand, there was spontaneous resolution of the lesions of the mildly affected animals over a period of 8 weeks. This result is consistent with the course of dermatophilosis infection in cattle with some animals dying as a result of secondary infection and others recovering spontaneously although with the possibility of a relapse.

### Serological response

The mean values of the passive haemagglutinating antibody (PHA) titres to CBPP vaccine are presented in Figure 1. Animals were positive within one week of

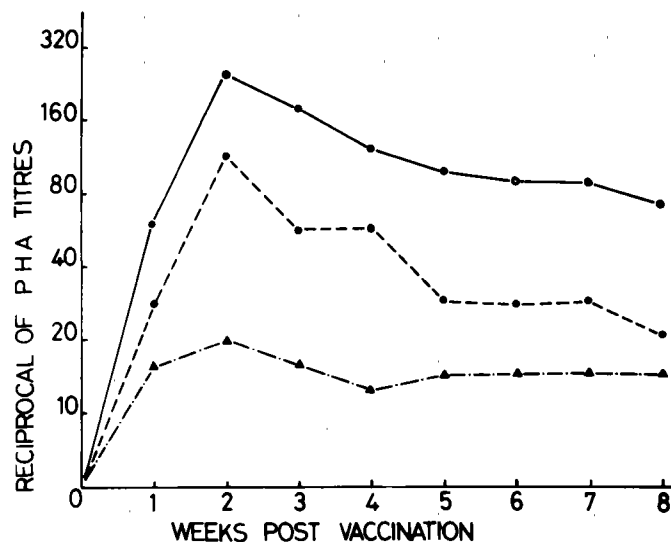


Fig. 1 : Immune response to CBPP vaccination in both the normal and dermatophilosis-infected cattle as measured by passive haemagglutination test.

Legend : Open circle = severely infected ; Closed circle = mildly infected ; Crosses = apparently normal.

vaccination with titres reaching peak values by the second week. There was not much variation in individual response within the respective groups. The response was markedly depressed in animals that were severely affected compared with the mildly affected ones and the controls. It is important to note that while the mean antibody titres of the severely affected group did not rise above 1:20 throughout the period of observation, titres of 1:80 were still recorded for the control group at ten weeks, after vaccination.

By the 10th week also the mean titres of the mildly affected group had dropped to less than 1:20. Although the graph demonstrated the mean titres up to 8 weeks post-vaccination, data were actually collected for about 10 weeks. Our statement is therefore based on actual data collected but not reflected in the graph because of the death of two of the infected animals earlier on.

Both the dermatophilosis-infected and control animals had *D. congolensis* antibodies in their sera prior to vaccination with CBPP vaccine (Fig. 2). However, the titre was very low in the control animals compared with the other two groups. The level of *D. congolensis* antibodies rose to a peak one week after vaccination (Fig. 2). This dropped to low levels by the second week. Whilst the level of *D. congolensis* antibodies in the control group was characterized by repeated transient rise and fall, the titres in the mildly and severely affected groups rose to another peak at the 6th and 9th week respectively.

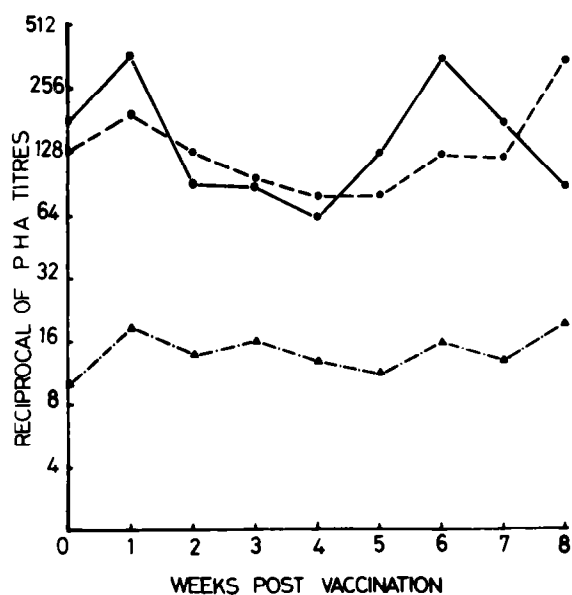


Fig. 2: Measurement of serum haemagglutinating anti-*D. congolensis* antibodies in both the normal and dermatophilosis-infected cattle following vaccination against CBPP.

Legend : Open circle = severely infected ; Closed circle = mildly infected ; Crosses = apparently normal.

## DISCUSSION

The results of the present study show that full

expression of immune potential is impaired in dermatophilosis-infected animals when vaccinated against CBPP. Although the number of animals in the subgroups of the infected animals is rather small due to the limited number of available clinical cases, the response, however, shows a definite trend. Further investigation is underway to determine whether the depressed humoral antibody response has any effect on protective immunity as was shown with trypanosomal infection by ILEMOBADE *et al.* (10).

BRUMMERSTEDT *et al.* (3) recorded abnormally low antibody responses in zinc-deficient Friesian cattle to immunization with tetanus toxoid. Since serum zinc level of *D. congolensis*-infected Zebu cattle has been reported by AMAKIRI, KAPU (1, 11) to be significantly lower than in healthy animals, it is necessary to investigate the role of this mineral deficiency along with other factors such as increased serum globulin level as reported by GBODI and CHECHET (7) in the depressed response to CBPP vaccine. The possibility of other infectious agents being responsible for the depressed immune response is ruled out because while the two infectious agents recovered from the dead animals are not known to be immunosuppressive, the other dermatophilosis-infected animals did not show signs of any other disease condition.

Mycoplasmas interact with host cells and tissues in a variety of ways. They are reported by FERNALD (6) to generate within the host, specific immune responses and non-specific effects such as stimulation and suppression of immune system both *in vivo* and *in vitro*. Although the mitogenic activity of *Mycoplasma mycoides* subsp. *mycoides* has not been studied like many other mycoplasmas by FERNALD, KIRCHNER, NAOT (6, 12, 15), the increase in serum level of *D. congolensis* antibodies must have been due to a non-specific or polyclonal release of immunoglobulin or blastogenesis. The biphasic nature of the response could not be explained but MAKINDE and WILKIE (13) observed a similar phenomenon following the experimental infection of rabbits with *D. congolensis*. Perhaps this is peculiar to the organism in its interaction with host cells and tissues.

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**CHIMA (J. C.), MAKINDE (A. A.), ONOVIRAN (O.), UMO (I.), PAM (G.).** Immune response to contagious bovine pleuropneumonia vaccine in dermatophilosis-infected animals. *Rev. Elev. Méd. vét. Pays trop.*, 1986, **39** (3-4) : 289-292

Five dermatophilosis-infected Zebu cattle and five apparently normal ones were vaccinated against contagious bovine pleuropneumonia (CBPP). The humoral antibodies to CBPP and *Dermatophilus congolensis* were measured with passive haemagglutination test. The immune response to CBPP in the three severely infected animals was markedly depressed compared with the two mildly affected ones and the control.

The significance of the non-specific increase in the serum level of *D. congolensis* antibodies following CBPP vaccination is briefly discussed. *Key words* : Zebu – Immune response – Contagious bovine pleuropneumonia – Dermatophilosis – Vaccine – Nigeria.

**CHIMA (J. C.), MAKINDE (A. A.), ONOVIRAN (O.), UMO (I.), PAM (G.).** Respuesta inmunológica a la vacunación contra la perineumonía contagiosa bovina en animales infectados por la dermatofilia. *Rev. Elev. Méd. vét. Pays trop.*, 1986, **39** (3-4) : 289-292.

Se vacunaron contra la perineumonía contagiosa bovina (PCB) 5 cebúes infectados por la dermatofilia y 5 cebúes aparentemente sanos. Se determinaron mediante la prueba de hemaglutinación pasiva los anticuerpos humorales de la PCB y a *Dermatophilus congolensis*. En los 3 animales más infectados, la respuesta inmunológica a la PCB fue muy reducida en comparación con la de los 2 animales medianamente infectados y con la de los testigos.

Los autores discuten brevemente de la significación del aumento no específico del nivel sérico de los anticuerpos a *D. congolensis* después de la vacunación anti-perineumonía. *Palabras claves* : Cebú – Respuesta inmunológica – Perineumonía contagiosa bovina – Dermatofilia – Vacuna – Nigeria.

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