IMMUNIZATION OF HEIFERS AGAINST GONADOTROPIN RELEASING HORMONE: EFFECTIVENESS OF ADJUVANTS

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Story in Brief

Prepuberal Angus x Hereford heifers (n=30) were used to evaluate the effectiveness of four adjuvants for active immunization against gonadotropin-releasing hormone (GnRH). Heifers received a primary immunization against GnRH conjugated to human serum albumin (HSA) which was emulsified in either Freund's complete adjuvant (FCA), Freund's incomplete adjuvant (FIA), DEAE dextran (DD) + FIA, or DD + mineral oil (MO). Booster immunizations were given at weeks 4 and 13 of treatment. Within two weeks after each booster, antibody titers for heifers on FCA, DD+FIA or DD+MO treatments were greater than titers for heifers on FIA or HSA. At week 30, heifers immunized with DD+FIA and DD+MO had less granulomas at injection sites in the mammary gland than heifers treated with FCA ($P<.001$). We conclude that DD+MO and DD+FIA are effective adjuvants to immunize heifers against GnRH, producing sufficient antibody response with minimal granuloma production at injection site.

(Key Words: Adjuvants, Heifers, Immunization, GnRH.)

Introduction

Heifers growing on pastures and in feedlots are less efficient than steers due to excess activity associated with estrous cycles or pregnancy. If puberty could be delayed in heifers, these problems could be reduced and efficiency of production would be increased.

The hypothalamus, at the base of the brain, produces GnRH (a peptide) which controls synthesis and secretion of luteinizing hormone (LH) and follicle stimulating hormone (FSH) from the pituitary. These gonadotropins (LH and FSH) stimulate the ovary to initiate estrous cycles at puberty.

Puberty can be delayed in heifers by immunizing them against GnRH (Wettemann & Castree 1988 and O'Connell & Wettemann 1989). Removal of GnRH by immunization, reduces LH secretion and prevents follicular growth and ovulation.

A problem associated with immunization against GnRH using FCA is production of granulomas at injection sites. The objectives of this experiment

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were to determine the ability of four adjuvants to stimulate antibody production and to determine which adjuvant caused the least inflammatory response at the injection site.

Materials and Methods

Thirty prepuberal Angus x Hereford heifers maintained on range conditions, weighing approximately 212 kg at 11 months of age were used. To enhance the immune response, GnRH was conjugated to human serum albumin (HSA) by the carbodiimide reaction. Heifers (n=30) were randomly allocated (n=6) to five treatments. The control group was immunized with HSA emulsified in Freund's complete adjuvant (FCA). The other four adjuvant treatments were GnRH-HSA emulsified in either Freund's complete adjuvant (FCA), Freund's incomplete adjuvant (FIA), DEAE dextran (DD) + mineral oil (MO) or DD+FIA. Heifers were immunized subcutaneously and intradermally at six sites in the mammary gland. Booster immunizations were given at weeks 4 and 13 of treatment to enhance antibody production against GnRH. Freund's incomplete adjuvant was used for the booster immunization for controls, FCA and FIA treatments. Booster immunizations for heifers on DD+MO and DD+FIA treatments were boostered with the same adjuvants used for primary immunizations. Mammary glands scores were recorded monthly utilizing a scale from one to six (Table 1). Jugular blood samples were taken weekly for 30 weeks to determine antibody titers against GnRH in serum and to quantify concentrations of progesterone in plasma by radioimmunoassay. Titers against GnRH were determined by measuring binding of ^{125}I-GnRH to diluted serum.

Results and Discussion

Within two weeks after each booster, titers against GnRH were greater in heifers on FCA, DD+MO and DD+FIA treatments compared with heifers immunized against HSA ($P<.01$) (Figure 1). Body weights were reduced ($P<.05$) in the FCA and control groups at week 30 compared with heifers on the other three treatments. This suggests that FCA may cause an inhibitory effect on growth rate. Mammary gland scores were less ($P<.005$) for heifers in FIA, DD+MO and DD+FIA groups compared with heifers given FCA (Figure 2). Only the DD groups had production of antibodies against GnRH and minimal granuloma production. Age at puberty was not influenced by treatment. This may be related to the early age before puberty that heifers were treated.

In summary, immunization against GnRH utilizing FCA, DD+MO and DD+FIA emulsions caused significant production of antibodies against GnRH. Heifers treated with DD+FIA and DD+MO had reduced mammary gland scores compared with FCA. Therefore, we conclude that DD+FIA and DD+MO are effective adjuvants for immunizing heifers against gonadotropin-releasing hormone.

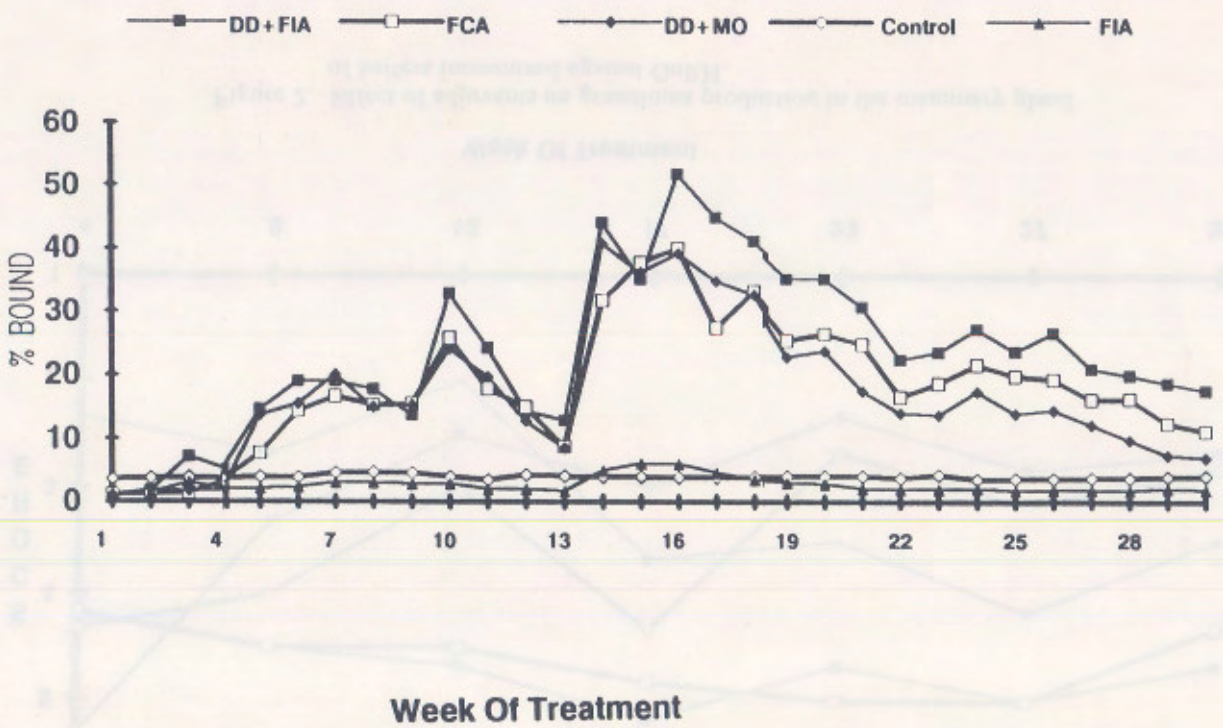

Figure 1. Effect of adjuvants on antisera titers against GnRH.

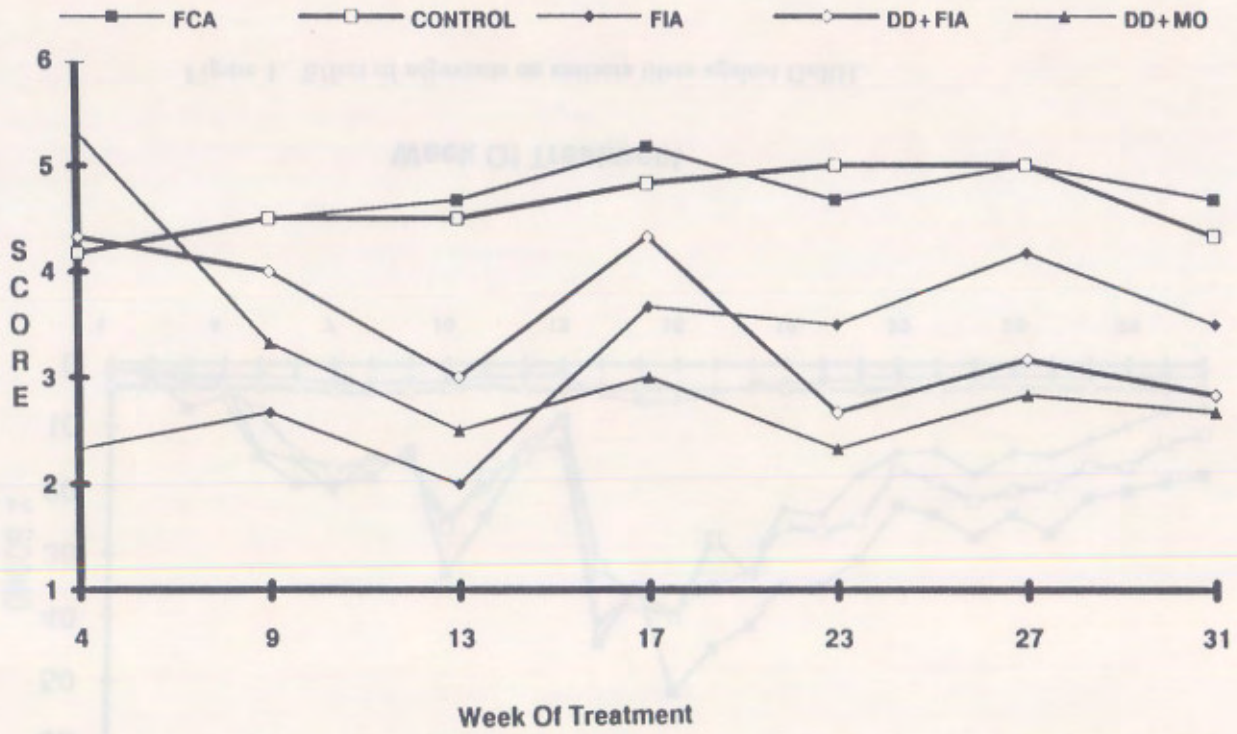

Figure 2. Effect of adjuvants on granuloma production in the mammary gland of heifers immunized against GnRH.

Literature Cited

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