IMMUNIZATION OF HEIFERS AGAINST LUTEINIZING HORMONE RELEASING HORMONE DELAYS PUBERTY AND CAUSES ANESTRUS

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Story in Brief

Ten prepubertal Angus x Hereford heifers at 13 months of age were immunized against luteinizing hormone releasing hormone (LHRH) to determine the long term effects of immunization and booster injections against LHRH on ovarian cycles. Half of the heifers were immunized against human albumin conjugates of LHRH and the other heifers were controls. Booster immunizations were given on days 42, 175, and 322 after the initial treatment. The onset of puberty was delayed an average of 11 weeks in immunized compared with control heifers. Booster immunization of treated heifers after cycles had been initiated caused the cessation of estrous cycles for about two months.

(Key Words: Anestrus, Heifers, LH, LHRH, Puberty.)

Introduction

The hypothalamus secretes LHRH which controls synthesis and release of luteinizing hormone (LH) by the pituitary. Secretion of LH is necessary for ovarian growth, puberty, and normal estrous cycles. Regulation of the pituitary gland has been studied by isolation of the gland by pituitary stalk section and hypothalamic lesions in many species. When these methods are used to separate the pituitary from the hypothalamus, many endocrine functions are disrupted. We have attempted to develop an immunological barrier to remove the secretion of LH from the control of the hypothalamus. In addition this technique may be useful to prevent pregnancy in stocker heifers.

The purpose of this experiment was to evaluate the effect of immunization of heifers against LHRH on the onset of puberty and ovarian function.

Materials and Methods

Ten prepubertal Angus x Hereford heifers at 13 months of age were used. Half of the heifers were immunized against LHRH conjugated to human serum albumin and the others were controls. The conjugate (2 mg) was emulsified in Freund's complete adjuvant and injected at five intradermal and five subcutaneous locations in the mammary gland. The prepubertal heifers were about 13 months of age when immunized (week 0).

On week 6, a booster immunization with incomplete adjuvant was given. Second and third booster immunizations were given on weeks 25 and 46. Blood plasma was obtained weekly for 14 months and progesterone was quantified to access ovarian luteal activity (OLA). Antisera titers to LHRH were determined at selected times.

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Results and Discussion

The interval from the initial immunizations until the onset of OLA was delayed 11 weeks in the immunized heifers (Table 1). Control heifers had OLA by 9.6 ± 1.4 weeks after the start of treatment and immunized heifers averaged 20.8 ± 2.4 weeks until OLA.

Antisera titer was evaluated at week 17. All immunized heifers had titers against LHRH (Table 1). The antisera titer was related to the length of time puberty was delayed. For instance, heifer 333 had the lowest antisera titer and the earliest puberty.

Figure 1 depicts concentrations of progesterone in a control heifer. Progesterone was first greater than 1 ng/ml on week 7, and the heifer continued to have normal ovarian cycles. Figure 2 depicts

Table 1. Ovarian luteal activity and antisera titer in heifers immunized against LHRH-HSA.

Heifer No	Treatment	Weeks to OLA	Binding of ^{125}I LHRH to antisera (%)[a]
75	I	16	16
302	I	25	24
333	I	14	6
338	I	25	32
342	I	24	17
X±SE	I	20.8±2.4	19±4
331	C	6	3
341	C	7	3
376	C	13	3
385	C	12	3
826	C	10	3
X±SE	C	9.6±1.4	3±0

[a] Antisera titer on week 17.

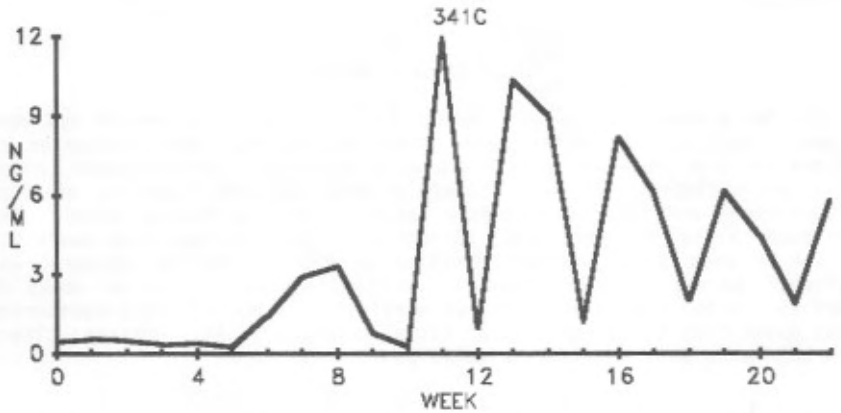

Figure 1. Concentrations of progesterone in plasma of a control heifer before and after puberty. Treatment was initiated on week 0.

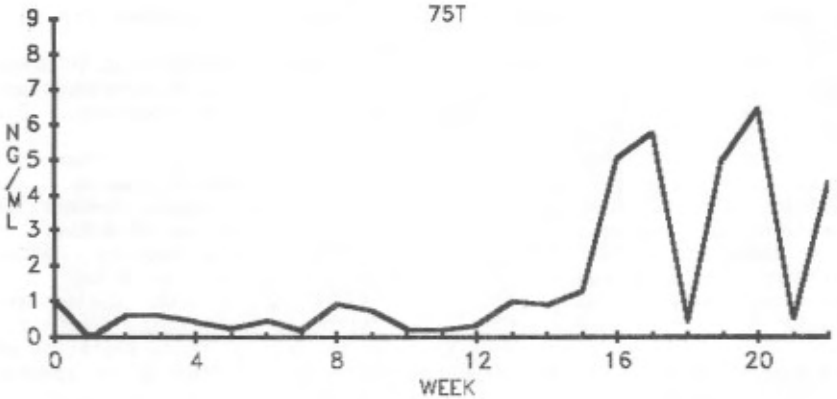

Figure 2. Concentrations of progesterone in plasma of a heifer with delayed puberty after immunization against LHRH. Treatment was initiated on week 0.

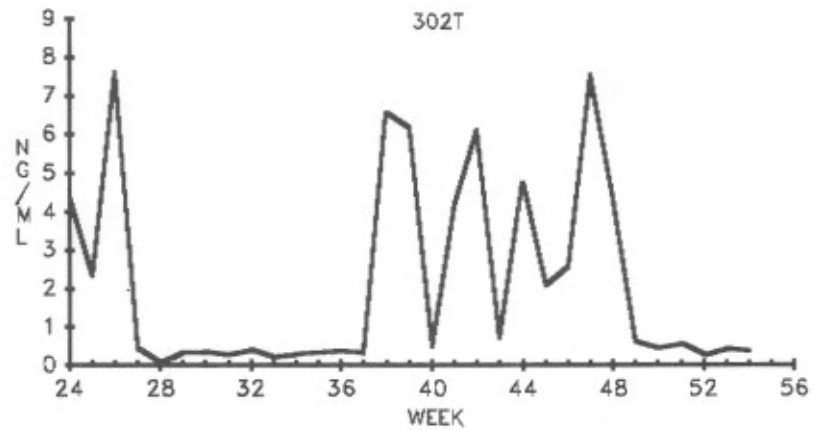

Figure 3. Concentrations of progesterone in plasma of a heifer immunized against LHRH at week 0. After puberty, booster immunizations against LHRH were given on weeks 25 and 46.

concentrations of progesterone in a heifer immunized against LHRH. Progesterone was less than 1 ng/ml until 16 weeks. Puberty was delayed for an average of 11 weeks in treated heifers. After OLA started, normal cycles continued.

Immunized heifers were given a second booster with incomplete adjuvant at 25 weeks after the initial treatment. All heifers exhibited normal OLA cycles at treatment. Three of the five heifers ceased OLA at

an average of 1 week after treatment. Anestrus persisted for 11.3 weeks.

Immunized heifers were given a third booster injection at 46 weeks after the initial treatment. All heifers were cycling at treatment and 4 of 5 became anestrus at an average of 3 weeks after treatment. The duration of anestrus was 8.2 weeks.

Figure 3 depicts concentrations of progesterone in a heifer that became anestrus after the booster injections on weeks 25 and 46. The typical response observed was that the corpus luteum present at treatment had a normal lifespan but further ovulation was inhibited.

Immunization of heifers against LHRH will delay puberty. After antisera titers decrease, normal estrous cycles are exhibited. If immunized heifers are given booster immunizations after cycles are initiated, ovarian luteal cycles cease for about two months. Immunization against LHRH is a technique that can be used to study secretion of gonadotropins and has the potential to prevent pregnancy in stocker heifers.