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Thomas H. Wise
MARC

Calvin L. Ferrell
MARC

Bruce D. Schanbacher
MARC

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Thomas H. Wise, Calvin L. Ferrell, and Bruce D. Schanbacher[1]

Introduction

Gonadal steroids mediate many responses throughout the body, many of which may have economic considerations. Antibodies made against steroids by active immunization have provided unique tools to begin to identify steroid target tissues and understand some of the body responses to gonadal steroids. Immunization of farm animals against steroids may potentiate their effects upon target tissues resulting in increased ovulation rate (androgens) and increased feed efficiency and rate of gain (estrogens).

A major secretion function of the ovary involves the release of sex steroids which have multiple effects upon the body. Follicles release estrogen, which prepares the animal for breeding. After ovulation, the follicle develops into a corpus luteum that secretes progesterone and enables the pregnancy to be maintained. Beyond these general concepts, our knowledge of sex steroidal effects upon the body are limited. Only recently have ovarian androgens (primarily a male gonadal secretion) been identified as having a possible role in follicular maturation. Estrogenic effects upon growth are well acknowledged and utilized to the advantage of cattle feeders, but actual mechanisms involved are unknown. The purpose of these studies were to (1) identify the reproductive effects of active immunization against androstenedione and (2) evaluate the mechanisms of antibody-steroid effects with active immunization against estradiol in feedlot heifers.

Procedure

Androstenedione and estradiol were linked to Keyhole limpet hemocyanin (KLH) or bovine serum albumin (BSA) to provide a stimulatory immune response in cycling beef heifers. In the first experiment, cycling heifers were actively immunized against the carrier protein (KLH) and the androstenedione antigen (Table 1). In the second experiment (II), animals were immunized against two different antigenic proteins linked to estradiol (BSA and KLH). Reproductive efficiency was monitored in the first experiment and rate of gain and feed conversion efficiency monitored in the second. Animals in experiment II were fed *ad libitum* for 170 days.

Results

Animals immunized against androstenedione had an increased ovulation rate (1.3/cow) resulting in 100 percent overall pregnancy rate in treated animals and 80 percent in control animals (Table 1). The increased ovulation rate in animals immunized against androstenedione implies that ovarian androgens are important in the recruitment and maturation of ovulatory follicles.

In experiment II, animals immunized against estrogen showed a classical increase in rate of gain and feed efficiency (Table 2) from the estrogenic effects upon target tissues. The animal's own estrogen was utilized to potentiate growth and feed conversion when immunized against estrogens. The two antigenic proteins utilized (KLH and BSA) revealed different responses at the ovarian level. Animals immunized against BSA conjugate were only 50 percent cyclic and had a large number of cystic follicles, whereas animals immunized against the KLH conjugate were normal in reproductive function (Table 2).

[1]Wise and Schanbacher are research physiologists, Reproduction Unit, and Ferrell is a research animal scientist, Nutrition Unit, MARC.

Table 1.—Comparison of fecundity and fertility of animals immunized against Keyhole limpet hemocyanin and Keyhole limpet hemocyanin conjugated to androstenedione

	Control-saline	Control-anti-KLH	Anti-androstenedione
Percent serum androstenedione binding (1:100)	< 1	< 1	21
Ovulation rate	1.0 (10/10)	1.1 (11/10)	1.3[a] (18/14)
Pregnancy rate, pct	80 (8/10)	70 (7/10)	79 (11/14)
Calves/cow	0.8 (8/10)	0.8 (8/10)	1.0 (14/14)

[a]$p < 0.06$.

Table 2.—Comparison of average daily gain and feed efficiency of animals actively immunized against estradiol conjugated to Keyhole limpet hemocyanin (Anti-KLH-estradiol) and bovine serum albumin (Anti-BSA-estradiol).

	Control-saline	Anti-KLH-estradiol	Anti-BSA-estradiol
Percent serum estradiol binding (1:100)	0.39	31.0	43.5
Ovulation rate	0.8 (15/18)	.9 (17/18)	0.5[a] (9/18)
Daily gain (lb)	1.83	2.09[a]	2.13[a]
Gain/Feed consumption (lb/lb)	0.118	0.126	0.142[a]

[a]$p < 0.05$.