

# INDUCTION OF ESTRUS IN THYROIDECTOMIZED- OVARIECTOMIZED, NONLACTATING, HOLSTEIN COWS

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## Summary

Low thyroid activity (hypothyroidism) has been reported to decrease sexual behavior associated with reproduction in several species. Using estradiol benzoate (EB) and progesterone ( $P_4$ ), we attempted to induce estrus in hypothyroid cows. Thyroid glands (thyroidectomy) and ovaries (ovariectomy) were removed surgically from nonlactating and nonpregnant Holstein cows that were culled from the Kansas State University dairy herd. Eight cows were thyroidectomized and ovariectomized (THYOVEX) and another four cows were ovariectomized only (OVEX). Starting 9 hr after injection of EB, cows were continuously observed for estrus for 36 hr. Frequencies of mounting activity and standing behavior were recorded for each cow. The percentage showing standing estrus was greater in cows that had no thyroid glands or ovaries than in cows without ovaries (78 vs 31%). Manifestation of estrus was identical in cows treated with EB or EB+ $P_4$  (62%). Interval from EB injection to onset of standing estrus, frequency of mounting activity, and duration of standing estrus were similar among treatment groups and unaffected by the type of hormonal treatment. Thyroidectomized cows can exhibit estrous behavior, which is similar to that in ovariectomized cows treated with EB or  $P_4$ +EB.

(Key Words: Thyroidectomy, Ovariectomy, Estrous Behavior, Cattle.)

## Introduction

Loss of thyroid gland activity (hypothyroidism) has been reported to affect behavior associated with reproductive function. Hypo-

thyroidism caused decreased sexual drive in bulls without affecting sperm production and obliterated estrous behavior in cows without altering development of follicles and eggs. Orally administered thyroprotein restored sexual behavior in both sexes. During estrus, thyroid activity was increased and concentrations of thyrotropin (a hormone secreted by the pituitary gland that stimulates function of the thyroid gland) were decreased compared to cows in midcycle. In the same study, anestrous cows had low levels of thyroid activity and thyrotropin. Based on these observations, an optimal level of thyroidal hormones appears to be necessary for the manifestation of estrous behavior in cattle. Our objective in the present experiment was to determine if estrus could be induced in thyroidectomized-ovariectomized, nonlactating cows using estradiol benzoate and progesterone.

## Procedures

Eight, nonlactating and nonpregnant, Holstein cows were thyroidectomized (leaving the parathyroid glands intact) and ovariectomized (THYOVEX), and a similar set of cows ( $n = 4$ ) was ovariectomized only (OVEX) in March. Animals were housed in a drylot and fed a maintenance diet of hay and concentrate. During August, all cows were treated with estradiol benzoate (EB) or progesterone plus EB ( $P_4$ +EB) to induce estrus. A crossover design with two replicates was used to allow complete balancing of potential carryover effects from hormonal treatment. The study was conducted over 4 consecutive wk. The estrous induction scheme was initiated on a Monday (0800 hr), at which time a progesterone-releasing intravaginal device (PRID) containing 1.5 g crystalline

progesterone was inserted into the vagina of half of the cows in each group for 72 hr. Twelve hr after PRID removal (or at a similar time in cows not receiving PRIDs), all cows received injections (i.m.) of EB (.5 mg/2 ml of safflower oil) to induce estrus. Continuous observations for estrous behavior began 9 hr after injection of EB and lasted for 36 hr. Individual estrous behavior was quantified by measuring the frequency of occurrence of mounting activity and whether or not the animal stood to be mounted by another cow.

Percentage of cows in heat was the number of cows demonstrating standing estrus divided by the total number of cows in the replicates of each treatment. Duration of estrus was the duration of time from the first to the last observed standing estrus. Estrous behavior was divided into four categories. An attempted mount (AMT) was recorded when one cow attempted to mount another, without the recipient standing immobile (attempted mount received; AMTR). A standing mount (SMT) was recorded when one cow mounted another, with the recipient standing immobile (standing mount received; SMTR).

### **Results and Discussion**

The percentage of cows showing standing estrus, interval from injection of EB to onset of standing estrus, and duration of

standing estrus are summarized in Table 1. The percentage of cows that exhibited standing estrus was higher ( $P < .01$ ) in the THYOVEX group compared to the OVEX group. However, one cow in the latter group showed little estrous activity during the 4-wk period. Two other OVEX cows were very active in mounting behavior and other estrous activity during the experiment, even though they failed to stand to be mounted. The last OVEX cow exhibited high frequencies of all estrous activity recorded. One THYOVEX cow failed to show estrous behavior, other than several attempts at mounting other cows. Interval from injection of EB to onset of standing estrus, duration of standing estrus, and behavioral traits indicative of estrus (Table 2) were similar between the THYOVEX and OVEX groups and also between the EB and  $P_4$ +EB treated cows. There were no interaction effects between physiological status and hormonal treatment. Pretreatment with  $P_4$  in EB-treated ovariectomized heifers did not affect the percentage in estrus, interval from EB to estrus, or behavioral signs of estrus.

Induction of estrous behavior in thyroidectomized cows demonstrates that low thyroid activity or hypothyroidism does not inhibit or diminish estrous behavior. Animals that are hypothyroid or in the low range of normal thyroid activity, such as early postpartum, lactating cows or heat-stressed cows, may not exhibit estrous behavior for other physiological reasons.

**Table 1. Characteristics of Estrus in Thyroidectomized and Ovariectomized (THYOVEX) and Ovariectomized (OVEX) Cows Treated with Estradiol Benzoate (EB) or Progesterone and EB (P<sub>4</sub>+EB)**

Status or treatment	Percentage of cows exhibiting standing estrus <sup>a</sup>	Interval from EB to first stand, hr	Duration of standing estrus, hr
THYOVEX	78.1 (25/32)**	15.4 ± .8	7.2 ± .6
OVEX	31.1 (5/16)	12.7 ± 1.8	9.5 ± 1.5
EB	62.5 (15/24)	13.8 ± 1.3	7.4 ± 1.1
P <sub>4</sub> +EB	62.5 (15/24)	14.4 ± 1.5	9.4 ± 1.2

<sup>a</sup>Numbers in parentheses are observations of standing estrus and total number of observations during the experiment.

\*\* (P < .01)

**Table 2. Characteristics of Estrous Activity during 36 hr after Treatment with Estradiol Benzoate (EB) or Progesterone and EB (P<sub>4</sub>+EB)**

Status or treatment	Frequency of estrous behavior <sup>a</sup>			
	AMT	AMTR	SMT	SMTR
THYOVEX	12.4 ± 2.7	8.9 ± 2.5	15.5 ± 3.6	21.2 ± 6.3
OVEX	12.9 ± 3.9	8.8 ± 3.5	20.1 ± 5.1	8.2 ± 8.9
EB	11.5 ± 3.3	7.8 ± 3.0	16.0 ± 4.4	12.2 ± 7.7
P <sub>4</sub> +EB	13.7 ± 3.3	10.0 ± 3.0	19.7 ± 4.4	17.3 ± 7.7

<sup>a</sup>AMT = attempted mounts; AMTR = attempted mounts received; SMT = standing mounts; and SMTR = standing mounts received.