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Characterization of serum hormone profiles in growing heifers implanted with anabolic growth promotants (2000)

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CHARACTERIZATION OF SERUM HORMONE PROFILES IN GROWING HEIFERS IMPLANTED WITH ANABOLIC GROWTH PROMOTANTS[1]

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Summary

A 147-day study was conducted to determine the sequential growth responses and serum hormone profiles of growing heifer calves implanted with anabolic growth promotants. Forty eight previously nonimplanted crossbred beef heifers averaging 396 lb were assigned to one of three treatments: 1) nonimplanted controls (NC), 2) Revalor®-G (REV-G), and 3) Synovex®-H (SYN-H). Accumulative gain response from day 84 through the end of the trial was significantly faster for both implant treatments than controls. Implant response was not consistent across time; heifers in both implant treatments gained faster than controls ($P<.05$) during the early (days 22-42) and later (days 64-84 and 85-105) weigh periods. By day 2, serum estradiol concentrations were increased in REV-G ($P<.05$) and SYN-H ($P<.01$) heifers relative to NC. Only REV-G contains trenbolone acetate, and none was detected in NC and SYN-H heifers, but serum levels in REV-G heifers were increased on days 2 ($P<.001$), 4 ($P<.05$), and 63 ($P<.001$). Only SYN-H contained testosterone; its level peaked by day 63 in SYN-H heifers. Throughout the study, progesterone was higher in NC heifers than in SYN-H or REV-G heifers, which suggests that the exogenous steroids reduced pituitary gonadotropin secretion and, thus, ovarian progesterone secretion. Our results suggest that the release of trenbolone and estradiol from REV-G implants is complete by 84 days after implanting.

(Key Words: Growth Promotants, Serum Hormones, Heifers.)

Introduction

Profit-minded cattle producers recognize that growth-promoting implants are indispensable tools for improving efficiency. Previous KSU field studies on stocker heifers showed that the gain response to implants depends on both implant type and the number of implants administered during the grazing period (Cattlemen's Day reports 1997 and 1998). Those studies also suggested that serum hormone concentrations vary between implant types over time. Hence, our objective was to characterize serum hormone profiles and performance of growing heifers implanted with Revalor®-G (40 mg trenbolone acetate and 8 mg estradiol) or Synovex®-H (20 mg estradiol benzoate and 200 mg testosterone propionate) compared to nonimplanted controls.

Experimental Procedures

This 147-day study was conducted from May through October, 1997, at the KSU Beef Cattle Research Center. A total of 48 British crossbred heifers averaging 396 lbs was assigned randomly to one of three treatments: 1) nonimplanted control (NC), 2) Revalor-G (REV-G) and 3) Synovex-H (SYN-H). All heifers were checked for previous implants, stratified by weight, and allotted randomly to treatment using the average of individual unshrunk weights on 2 previ-

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ous weigh days (days !2 and !1). All heifers were fed in one pen, once per day. The ration was 65% sorghum silage, 20% wheat middlings, 10% rolled corn, and 5% supplement (as-fed basis). Table 1 shows the same ration converted to a dry basis. The targeted gain of 2 lb/day was intended to be comparable to the gain in grazing studies conducted previously on smooth bromegrass and winter rye.

Table 1. Dry Matter Composition of Growing Diet[a]

Ingredient	% of DM
Sorghum silage	40.3
Wheat middlings	34.7
Dry-rolled corn	17.6
Supplement	7.4

[a]Formulated to provide 14.6% crude protein, .43 Mcal/lb Neg, 1.04% calcium, 0.53% phosphorus, and 25 g/ton Rumensin®.

On day 0, implants were administered according to manufacturers' recommendations. Unshrunk weights and blood samples for serum hormone analysis were collected on days 0, 2, 7, 14, 21, 42, 63, 84, 105, 126 and 147. Samples were analyzed for trenbolone acetate (TBA), testosterone (T2), estrogen (E2), and progesterone (P4).

Live weight gain data were analyzed as a completely randomized design with treatment as the sole source of variation. All hormone data were analyzed as a split-plot analysis for repeated measures. The model included the effect of treatment in the main plot (tested by the animal within treatment variance) and time and the treatment × time interaction in the subplot. Treatment × time means were compared only when a significant effect of the interaction term was found.

Results and Discussion

Table 2 presents heifer performance by treatment during successive weigh periods. Daily gains of REV-G and SYN-H heifers were similar (P>.05) to those of the NC heifers during the first 21 days. However, heifers in both implant treatments gained 10 to 27% faster than controls during the next five 20-day weigh periods. During the final two weigh periods, SYN-H heifers gained numerically faster than either REV-G or NC heifers.

Table 2. Effect of Implant Type on Heifer Daily Gains during Successive 20-Day Weigh Periods

	Treatment[a]		
Period of Study (Days)	NC	REV-G	SYN-H
0-21	2.10	2.26	2.01
22-42	2.49[b]	2.92[c]	2.91[c]
43-63	2.12	2.44	2.40
64-84	2.65[b]	3.11[c]	2.91[bc]
85-105	1.97[b]	2.34[bc]	2.50[c]
106-126	1.92	1.99	2.07
127-147	1.79	1.50	1.96

[a]NC = Nonimplanted control; REV-G = Revalor® -G; SYN-H = Synovex®-H. All implants were administered on day 0.
[b,c]Values in rows not sharing a common superscript are different (P<.05).

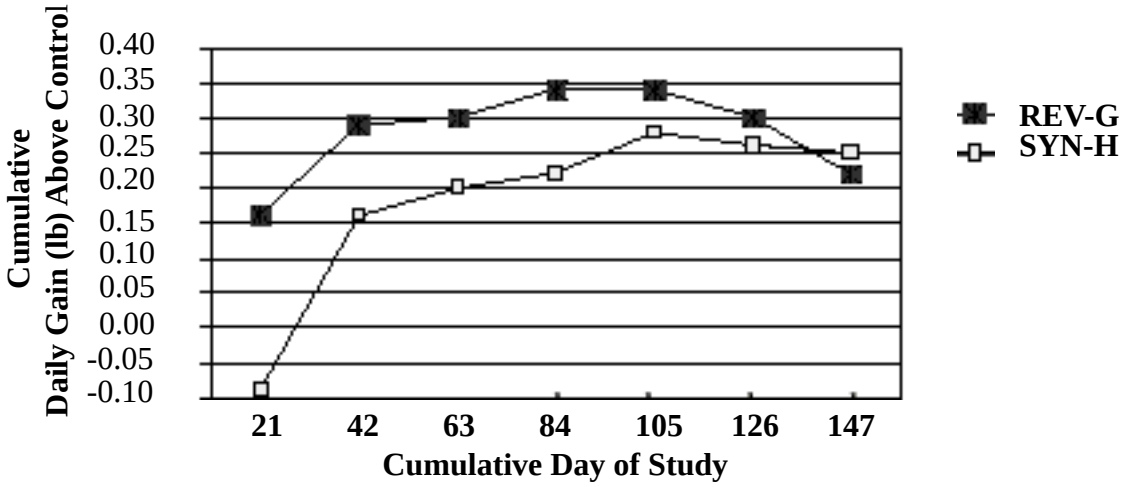
Figure 1 shows the accumulative growth responses of REV-G and SYN-H heifers relative to controls over the 147-day study. In contrast to earlier KSU studies where heifers responded rapidly to SYN-H and REV-G implantation, the implanted heifers in our study gained similarly (P>.05) to controls during the first 21 days. By day 42, the cumulative daily gains of both implanted groups were numerically greater than those of controls. From day 84 through the end of the study, cumulative daily gains of both implant groups were greater (P<.05) than those of controls. The lack of a significant gain response to the implants early in the study may have been related to intensive handling and blood sampling. Although the

amplitude of the growth response was higher for REV-G heifers, the gain response to SYN-H seemed to be sustained longer. These observations are consistent with previous KSU field trials.

Figure 2 shows the serum hormone concentrations of the heifers throughout the 147-day study. As expected, estradiol concentrations were similar among all treatments on day 0. But by day 2, estradiol levels were increased in both REV-G (P<.05) and SYN-H (P<.01) heifers. Serum estradiol declined rapidly in REV-G calves, and remained similar to the level in controls throughout the remainder of the study. Serum estradiol was higher in SYN-H heifers than in both control and REV-G heifers on days 7, 14, 42, and 105. The lack of a clear increase in serum estradiol in REV-G heifers likely reflects the lower estradiol concentration in that implant.

As expected, only the REV-G heifers contained measurable serum levels of trenbolone. All samples from NC and SYN-H heifers were below the detection limit of the assay (10.0 pg/mL). Trenbolone was elevated in REV-G heifers on days 2 (P<.001), 4 (P<.05), and 63 (P<.001). Thereafter, serum trenbolone levels were similar across the three treatments.

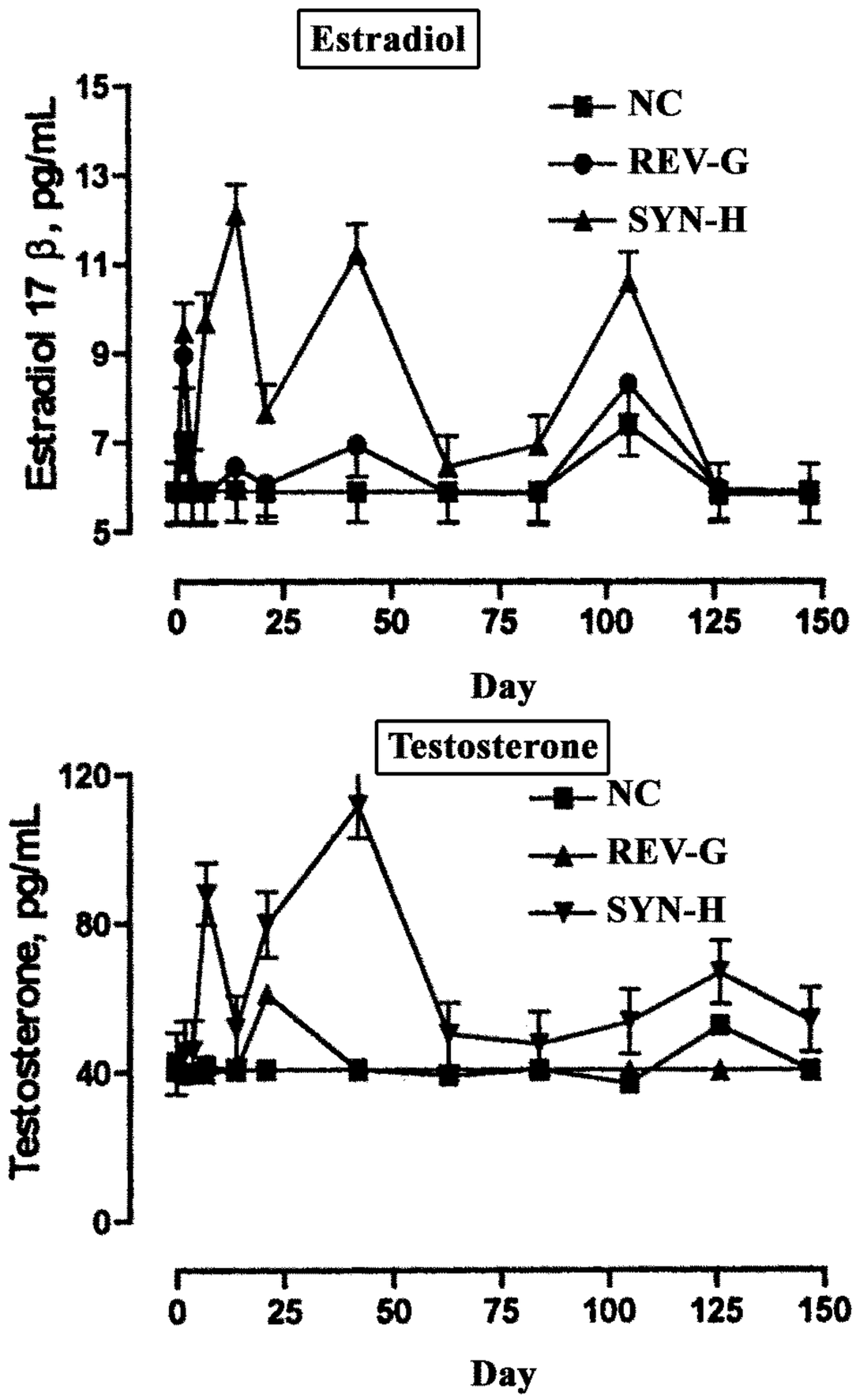
Averaged across the 147-day study, serum testosterone level was higher in SYN-H heifers (61.5+1.8 pg/mL) than in NC (41.2+6.9 pg/mL; P<.01) or REV-G (42.0+6.9 pg/mL; P<.01) calves. That was expected because only the SYN-H implant contained testosterone. Progesterone concentrations trended upward in all treatments as the study progressed, and this is reflected (P<.001) in a day of sampling effect. The most reasonable explanation is that, with increasing age, more heifers were becoming pubertal, and therefore exhibited luteal function and increased progesterone secretion. Averaged over all sampling days, progesterone was higher (P<.05) in NC heifers (1.3+.2 ng/mL) than in REV-G (.7+.2 ng/mL) or SYN-H (.7+.2 ng/mL) calves. That is diffi-cult to reconcile. However, the exogenous steroids may have decreased pituitary gonadotropin secretion, which, in turn, delayed puberty or at least resulted in reduced progesterone secretion.



a REV-G = Revalor-G; SYN-H = Synovex-H.

b Daily gain of implanted heifers significantly different from nonimplanted controls (P<.05).

Figure 1. Cumulative Growth Responses of Heifers to Growth Implants Relative to Nonimplanted Controls[a].



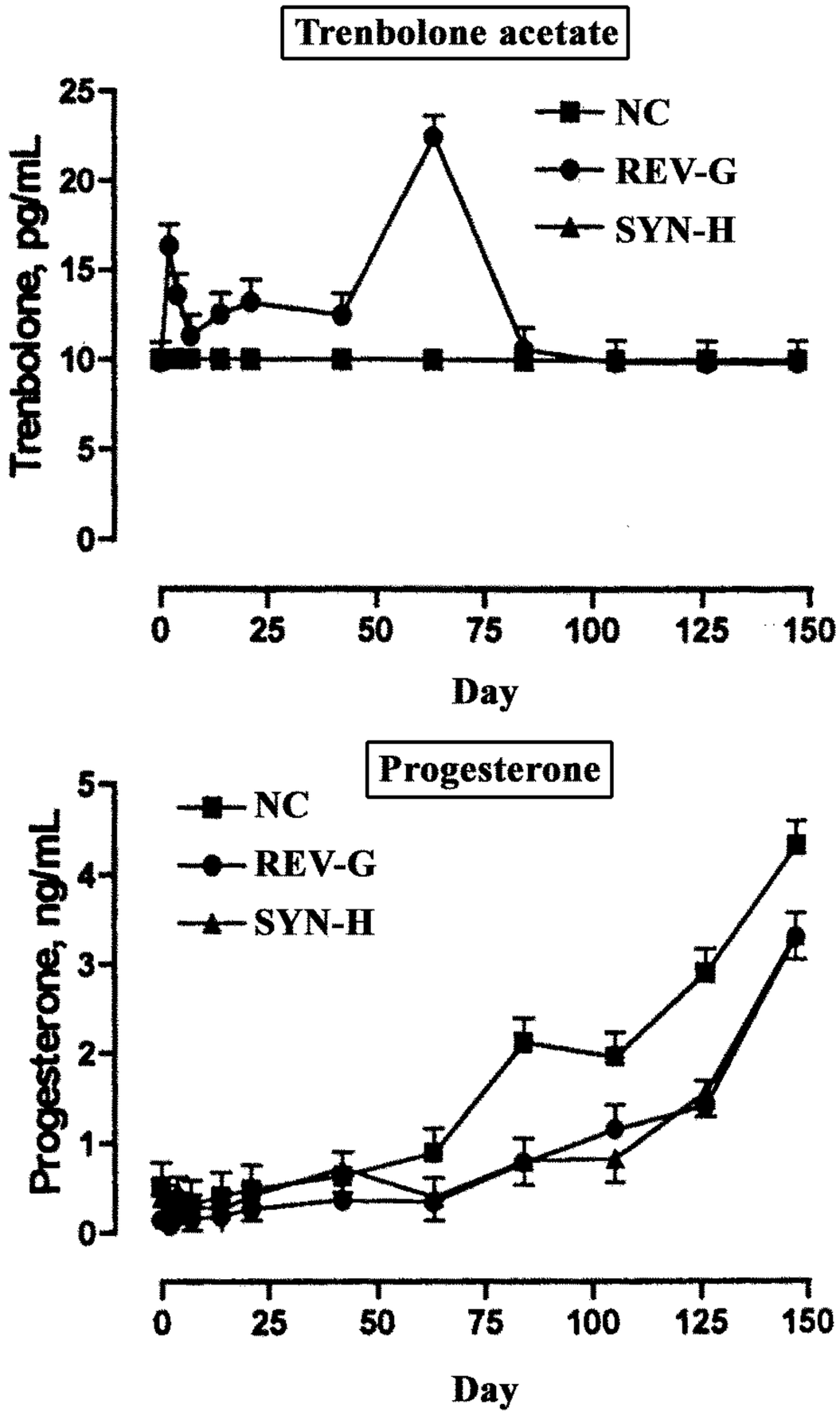


Figure 2. Serum Hormone Concentrations in Heifers Implanted with Revalor-G (REV-G) or Synovex-H (SYN-H) and in Nonimplanted Control (NC) Heifers over Time