INDUCTION OF LACTATION IN PREGNANT HEIFERS WITH 9-FLUOROPREDNISOLONE ACETATE

Recent experiments have indicated that adrenal glucocorticoids can initiate milk secretion in laboratory animals before or during mid-pregnancy without disturbing the pregnant state (4, 5, 7). In pregnant rats (7) or mice (5) prolactin was unable to initiate milk secretion, whereas in pregnant rabbits (4) either prolactin or cortisol acetate initiated lactation.

Most workers agree that adrenocorticotrophic hormone (ACTH) or cortisol administration depresses established lactation in the cow (1, 2, 6). However, relatively large doses of these hormones were employed. The possibility that these hormones in proper doses might be able to initiate or stimulate lactation in cattle has not been investigated.

PROCEDURES AND RESULTS

A total of ten pregnant Holstein heifers was used in these preliminary experiments. Four heifers, each pregnant approximately three and one-half months, were divided equally into control and experimental groups. The two experimental animals were injected intramuscularly, daily for seven days, with 10 mg of 9-fluoroprednisolone acetate (Predef), followed by injections of 15 mg per day for eight days. The control heifers received no treatment during this period. Twice-a-day milking was begun on the day of the last injection in both experimental and control heifers and milking was continued for 14 days.

The two Predef-treated heifers showed a partial filling of the udder during the last few days of treatment, in contrast to the appearance of the udders of the control heifers, which remained undistended (Figure 1). Milk yields of the two Predef-treated heifers were 0.25 and 1.75 lb, respectively, at the first milking, and the maximum daily yield attained was 1.5 lb.

Predef was kindly supplied by Dr. Robert Zimbelman of the Veterinary Division of the Upjohn Company, Kalamazoo, Michigan.

Fig. 1. (A) Udder of control heifer at beginning of experiment. (B) Udder of control heifer after 15 days of no treatment. (C) Udder of experimental heifer at beginning of experiment. (D) Udder of experimental heifer after 15 days of injection with Predef. All heifers were pregnant three and one-half months at beginning of experiment.

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and 2.0 lb of milk. The average daily production for the two heifers was 0.82 lb during the 14-day milking period. No milk was obtained from the control heifers during the entire 14-day milking period. All four heifers were examined by rectal palpation 1 wk after milking was begun, and it was determined that gestation had not been disturbed. At this writing these four heifers are in their fifth month of gestation.

In a second experiment a heifer, pregnant five and one-half months and with only three functional quarters, was injected intramuscularly with 15 mg of Predef daily for seven days. On the fifth day of injection the udder suddenly filled with secretion as if parturition had occurred. Twice-a-day milking was begun on the sixth day of Predef injection and 4.7 lb of milk were obtained. Daily milk production steadily increased until the 20th day, when the milk yield reached 22 lb. Daily milk production was maintained at a level of 19-22 lb for an additional 11 wk, then declined during the week immediately preceding parturition to an average of 14.8 lb daily. After a normal calving, milk production increased to an average of 39.9 and 44.7 lb per day during the first and second week, respectively. The calf was normal in all respects.

In a third experiment five heifers, all purchased from the same farm, and pregnant seven and one-half months, were treated as follows: Three heifers were injected intramuscularly with 15 mg of Predef daily for six days and two heifers received no treatment (controls). The udders of the Predef-treated heifers suddenly became distended with milk on the fifth day of injection, whereas the udders of the control heifers remained unchanged. The appearance of the udder of one of the control and one of the Predef-treated heifers on the initial day of the experiment and one day after the treatment period is shown in Figure 2.

Twice-a-day milking was started in both control and Predef-treated heifers seven days after the experiment commenced. Production at the first milking in the three Predef-treated heifers was 10.0, 11.0, and 8.4 lb, respectively; whereas, the two control heifers gave no milk. Milk yields rapidly increased in the Predef-treated heifers to an average of 17.5 lb on the third day, 21.0 lb on the sixth day, and reached a maximum daily average of 28.3 lb per heifer on the tenth day. Control heifers also came

![Figure 2: (A) Udder of control heifer at beginning of experiment. (B) Udder of control heifer after six days of no treatment. (C) Udder of experimental heifer at beginning of experiment. (D) Udder of experimental heifer after six days' injection with Predef. All heifers were pregnant seven and one-half months at beginning of experiment.](image-url)
into milk, as a result of the milking stimulus, and averaged 3.2 lb on the third day, 12.0 lb on the sixth day, and 20.0 lb on the tenth day of milking. Since the milking stimulus results in the release of ACTH (3) as well as prolactin, it is suggested that ACTH was released in greater amounts and stimulated increased adrenal cortical hormone production which initiated lactation in the control heifers. The daily milk yield before parturition for the three Predef-treated heifers averaged 23.0 lb and for the control heifers, 18.8 lb.

Both control and Predef-treated heifers calved an average of 12.0 and 24.7 days before expected due dates, respectively. Thus, lactation before parturition averaged 24.0 and 17.3 days for control and Predef-treated heifers, respectively. The two calves from the control heifers lived 1 and 11 days after birth, whereas the three calves from the Predef-treated heifers lived 0, 1, and 13 days after birth. Gross appearance of the calves indicated that all were born in a somewhat premature state. Since both the control and Predef-treated heifers calved early and all calves died shortly after birth, the conclusion can not be made that the Predef injections were responsible for these results. Although there was no apparent disease in these heifers, this possibility cannot be absolutely excluded. During the 2-wk period after parturition, the control heifers averaged 32.0 lb and the Predef-treated heifers 37.9 lb of milk per day.

CONCLUSIONS

These preliminary results are believed to be the first to indicate that lactation can be initiated during pregnancy in heifers by injecting an adrenal cortical steroid (9-fluoroprednisolone acetate) for a short period of time. Lactation was initiated during early, mid-, and late pregnancy without any apparent disturbance of the pregnant state. This suggests that adrenal cortical steroids are limiting factors for initiation of lactation in pregnant heifers, as in pregnant laboratory animals.

H. A. Tucker
J. Meites
Departments of Dairy and Physiology
Michigan State University
East Lansing

Additional studies on pregnant heifers suggest that longer treatment with Predef (15 mg daily for 12 days) may induce abortion during late gestation.

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REFERENCES