Preventive Effects of TRH on the Depression of Milk Production and Plasma Triiodothyronine Level in Lactating Cows Treated with Dexamethasone

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Glucocorticoids are considered to be one of the essential hormones for the maintenance of lactation in various species¹⁾. However, it has also been known that the administration of a large amount of glucocorticoids^{2,3)} or ACTH⁴⁾ to lactating cows induced a marked decrease of milk production. Dexamethasone (DX) is one of the most potent glucocorticoids having such action^{2,3)}.

Recently, it has been found that synthetic thyrotropin releasing hormone (TRH) administration to lactating cows stimulated the secretion of thyrotropin⁵⁾, thyroid hormones⁶⁾, prolactin, and growth hormone^{6,7)}. These hormones have galactopoietic effects in ruminants¹⁾. Accordingly, there is the possibility that simultaneous administration of TRH with DX might prevent the depression of milk production caused by DX. As far as we know, no such attempt has been reported. The present paper deals with the effects of synthetic thyrotropin releasing hormone tartarate (TRH-T) on the depression of milk production and plasma triiodothyronine (T3) caused by the administration of dexamethasone phosphate (DX).

Nine lactating Holstein cows from the Institute herd, producing 12 to 20 kg milk per day in the middle stage of lactation, were divided equally into three groups. Animals in Group I received a single subcutaneous injection of 10 mg of DX. Animals in Group II were treated with simultaneous injections of 10 mg DX and 2 mg TRH-T subcutaneously, followed by an additional subcutaneous injection of 1.5 mg TRH-T 5 hours later. Saline was injected to animals in Group III. Blood samples were obtained 0, 2, 5 and 24 hours after the treatment. In animals of Group II, the blood sample at 5 hours was obtained immediately before 2nd TRH-T injection. Plasma T3 was determined by T3 radioimmunoassay kits (Dinabot Radioisotope Laboratory). In Group I, the mean milk production on the following day of the DX injection decreased to 71% of the mean of the control milk yield during 7 days immediately before the treatment ($P < 0.01$). The decrease of milk production continued for the following 3 to 4 days (Fig. 1-A.). The milk yield returned to the control level 7 to 8 days after the treatment. No significant difference of milk production was observed between Group II and III throughout the experimental period. DX administration showed the most prominent effect on plasma T3 level among the hormones determined. Plasma T3 level in Group I, 24 hours after DX injection, decreased to 47.6% of the value at time 0 ($P < 0.01$). While no decrease of plasma T3 was observed in Group II and III (Fig. 1-B.).

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Fig. 1. Changes of milk production and plasma T₃ concentration after the injection of DX or DX+TRH combination.

A: Milk production in animals of Group I(○) on a day after subcutaneous DX injection decreased to 71% of the mean milk yield during 7 days immediately before the treatment. No comparable depression was observed either in Group II administered DX+TRH-T subcutaneously (●) or saline injected animals in Group III(△). The arrow shows the hormones or saline injection on day 0.

B: Plasma T₃ levels in animals of Group I(○) 24 hours after DX treatment decreased to 47.6% of the value at time 0. In animals of Group II(●), 2.1 folds increase was obtained 5 hours after the first TRH-T treatment. No significant changes were observed in animals of Group III(△). The arrow at time 0 shows DX, or DX+TRH-T or saline injection. The arrow at 5 hours indicates an additional injection of TRH-T to animals of Group II.

Furthermore, plasma T₃ levels in Group II were significantly elevated 2 and 5 hours after the injection ($P < 0.025$, $P < 0.01$, respectively). No increase of milk production in Group II may be attributed to the dose of TRH-T and the relatively short duration of elevated levels of plasma T₃ and other hormones. No comparable marked depression in basal plasma levels of either growth hormone or prolactin was observed in animals of Group I (JOHKE and HODATE, unpublished data). Simultaneous administration of DX with a large amount of thyroid hormone or growth hormone instead of TRH-T partly prevented the depression of milk production caused by DX⁸⁾. On the other hand, no preventive effect was observed after simultaneous administration of prolactin with DX.

The data suggest that main preventive effect of administered TRH-T on the depression of milk production resulted from DX injection may be caused by the maintenance or activation of thyroid function and also increase of growth hormone secretion.

TRH and Dexamethasone on Milk Production

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