

RELATIONSHIPS BETWEEN PLASMA THYROXINE CONCENTRATIONS AND THE
RESPONSES OF NEWBORN LAMBS TO HYPOTHERMIA

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Newborn lambs have higher plasma thyroxine (T4) concentrations than their mothers if the ewes have adequate iodine nutrition. Lambs born with goitre due to iodine deficiency may have plasma T4 less than their mothers (Andrewartha et al (1980), and are particularly susceptible to cold stress. Little attention has been given to the role of thyroid hormones in the response of newborn lambs to cold (Alexander 1970), and experiments were conducted to determine if any relationships existed between this response and plasma T4.

In 16 pregnant crossbred ewes the foetal lambs were operated on between 90 and 125 days of gestation. A catheter was placed in the foetal carotid artery to enable blood samples to be collected. In 13 lambs the thyroid glands were removed and these thyroidectomised lambs were supplemented with either 0, 2.5, 5, 8 or 10 µg T4/day to provide a group of lambs with a range of plasma T4 at birth. Daily injections of between 8 and 10 µg T4/day maintained plasma T4 of the thyroidectomised lambs at similar levels to those of 3 control lambs.

All 13 thyroidectomised lambs were born alive and had plasma T4 ranging from 0 to 61 µg/l. Six of the lambs died shortly after birth, and 7 could stand and suck the ewe. The catheterized control lambs, 10 lambs born in a paddock, and 10 born in a shed had plasma T4 ranging from 36 to 98 µg/l at birth. The plasma T4 in ewes ranged from 30 to 43 µg/l.

The resistance of the 30 suckled newborn lambs to hypothermia was determined in a progressively cooled water bath where the temperature was reduced from 38°C to 24°C in 30 minutes and then to 20°C over the next 30 minutes (Slee et al 1980). Lambs were removed from the bath when rectal temperature decreased to 35°C, and rewarmed in air.

There was a significant positive relationship between plasma T4 concentration and the time taken for the rectal temperature of lambs to decrease to 35°C ($r=0.73$ $p<0.001$). The maximum rate of decrease in rectal temperature in the bath (summit metabolism) was not significantly related to plasma T4 concentration. The rate at which rectal temperature increased in air was positively related to plasma T4 ($p<0.001$) and the times taken for rewarming were prolonged if plasma T4 was less than 50 µg/l. Plasma glycerol concentrations increased during hypothermia and were taken to indicate catabolism of brown fat: the increases were positively related to plasma T4 ($p<0.001$).

It would appear that newborn lambs with plasma T4 less than 50 µg/l may have functional hypothyroidism with increased susceptibility to hypothermia. A diagnosis of hypothyroidism in newborn lambs can be made if their plasma T4 is less than that of their mothers or less than 50 µg/l.

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