The Effect of Induced Hypothyroidism on Fertility of Goats During Summer Season

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Abstract :

The effects of Carbimazole (CZ)-induced hypothyroidism were investigated in goats during summer season. CZ treatment at a daily dose of 3mg/kg body weight for 11 days inhibited ovulation and corpus luteum formation. This suggested that heat stress, which usually causes a decline in thyroid hormones, may produce its effect on fertility in a similar manner to CZ-induced hypothyroidism.

Introduction:

Summer heat stress reduces fertility during summer in animals (Monty and Wolf 1974). Numerous reports have indicated that hot summer season causes a lowering of thyroid activity, resulting in low plasma concentration of thyroid hormones in most studied animals (Johnson and Vanjmack 1976; Hart *et. al,* 1979; Bell *et. al* 1985; Nixon *et. al* 1988; El Nouty *et. al* 1990). Thyroid hormones modulate metabolic processes (Ganong 2001; Browning *et. al* 1998). These metabolic hormones are involved in thermoregulation, because metabolism is a primary intrinsic source of heat (Finch 1986). This study was conducted to investigate the effect of induced hypothyroidism on fertility of goats during summer season.

Materials and Methods:

Animals: sixteen mature (2 -3 years) females Arady goats (weighing 25-30 kg) were used. They were housed in individual pens during summer season (June - August). After completion of one normal oestrous cycle (19 -20 days), the goats were randomly divided into two groups A&B. The treatment administered to each group A&B was as follows:

Animals in Group A (N = 8, Controls) received drench of saline from the Day of oestrous to Day 10 of the oestrous cycle (oestrous = Day 0).

Animals in Group B (N = 8) were treated exactly as Group A but with carbimazole (CZ) tablets (Neomercazole, Nicholas laboratories Ltd. UK). The tablets were powdered and dissolved in distilled water and given by drench at the rate of 3 mg/kg body weight.

In Groups A and B jugular blood (5ml) was collected daily by venipuncture using 23- gauge needle between Days 0 -20 of the oestrous cycle and the subsequent oestrous cycle. All blood sample were collected into heparinized nylon syringes and centrifuged at 1500 9 for 10 minutes. Plasma samples were stored at -20 °C until analyzed for hormones. All female goats were checked for oestrous twice daily by using a fertile buck and considered to be in oesrous when they stood for mounting.

Hormone Analysis: Progesterone and 13.14 dihydro-15 ketoprostaglandin, F2a (FGFM), the metabolite of prostaglandin F2a were measured by specific radioimmunoassay previously validated (Homeida and Cooke, 1982: Homeida, 1986). The intra- and inter-assay coefficients of variations were 4.4% (n = 15) and 12% (n = 20) respectively, for progesterone and 5.6% (n =10) and 11 % (n =15) respectively, for PGFM. The sensitivity of the assay was 48 pg/tube for progesterone and 10 pg/tube for PGFM. Extraction efficiency was 85.4 ± 4.8 % for progesterone and 87.1 ± 5.1% for PGFM and the results were corrected for extraction losses.

Statistical analysis: the results were compared by Student's t- test.

Results:

Similar pattern of hormone concentration during the first oestrous cycle in both Group A and B (Table 1) was observed. CZ produced no effect on luteal regression or oestrous. In the subsequent oestrous cycle, complete failure of luteal phase occurred in Group B. Progesterone values remained less than 0.1 ng/ml, which were significantly ($P < 0.001$) lower than values in Group A during days 5,10, and 15 of oestrous cycle. PGFM values were similar in the two groups, but significantly different ($P < 0.001$) on Day 15 of second oestrous cycle.

Table (1)

Mean (± SD) plasma concentrations ofprogesterone and 13,14-dihydro-15-ketoprostaglandin F2a (PGFM) during two oestrous cycles in goats treated with saline (Group A) or carbimazole (Group B).

Days of Oestrous cycle	Progesterone (ng/ml)		PGFM (pg/ml)	
	Group A	Group A	Group B	Group B
0	< 0.1	< 0.1	800 ± 25	850 ± 25
5	2.9 ± 0.1	2.6 ± 0.1	50 ± 10	7 ± 10
10	4.3 ± 0.2	4.1 ± 0.2	80 ± 10	100 ± 10
15	2.1 ± 0.1	2.5 ± 0.1	680 ± 20	720 ± 20
0	< 0.1	< 0.1	950 ± 25	1050 ± 25
50	2.8 ± 0.1	< 0.1*	70 ± 10	110 ± 10
10	4.4 ± 0.2	< 0.1*	105 ± 10	75 ± 10
15	2.5 ± 0.1	< 0.1*	660 ± 20	70 ± 10*

* P<0.001

Discussions:

Induction of altered thyroid function by CZ in goats and laboratory animals have been reported earlier (Baquer *et. al.*, 1976); Ibrahim *et. al.*, 1984). The relative longer life span of goats when compared to laboratory animals, makes them of practical consideration to be used as a model to study chronic complications during altered thyroid function. The main objective of this study was to examine the role of hypothyroidism on fertility of goats during summer season when ambient temperature in this part of the world reaches a quiet high values. The results have indicated that CZ-induced hypothyroidism produced no effect on reproductive homlones initially, when administered during oestrous cycle. But in the subsequent oestrous cycle, ovulation did not occur as indicated by failure of corpus luteum fomlation and absence of progesterone rise thereafter. Similar results due to thyroidectomy or suppression of thyroid function in female goats have been shown to impair or even abolish nomlal ovarian function (Reddy *et al.*, 1990; Walkden-Brown *et al.*, 1990). Such results may be explained by the possibilities that impaired thyroid function may affect steroid feedback responses required for generation of pre-ovulatory luteinizing hormone surge and suppression of ovulation (Webster *et al.*, 1991; Anderson and Barrell, 1998). The possibility for secretions of thyroid gland other than its hormones required for normal ovarian function cannot be ruled out.

Thyroid function in animals should decline as an acclimation response to increased heat after a few days to help alleviate heat stress (Pratt and Wettemann , 1986). This decline in thyroid function during heat stress may be due to effect of heat on hypothalamic-pituitary axis to cause reduction in thyrotrpoin releasing hormone which enables the animal to reduce basal metabolism (Johnson, 1987). Such decline in thyroid function may sometimes reduce fertility in animals as in case of CZ- induced hypothyroidism.

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تأثير تبيط الغدة الدرقية المستحث على إخصاب الماعز خلال فصل الصيف

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الملخص :

لقد تم دراسة تأثيرات الكاربازرل المخصص لنشاط الغدة الدرقية في الأغنام خلال فصل الصيف. ولقد تبين أن الجرعة اليومية بمقدار ٣ ملجرام للكيلوجرام من الكاربمازول ولمدة ١١ يوما ثبطت عملية التبويض وتكوين الجسم الأصفر. وتشير النتائج إلى درجة الحرارة العالية والتي عادة ما تقلل من هرمونات الغدة الدرقية ربما أثرت على خصوبة الحيوانات عبر هرومونات الغدة الدرقية كما هو الحال في المعالجة بالكاربمازول.